Injurious distentions & obstructions to circulation —

Breathing.

What for? —

Different modes:— all over — trachea — gills — lungs
frogs — ^ (birds) —

Our way — ribs & diaphragm —

Inspiration. men — women — children —

Expiration. ~~Expiration~~ —.

Quantity breathed — 16 to 18 t. per min.

~~Changes in the air~~

Changes in the blood —

Drowning — suffocation —

Animal Heat —

Ours — animals — birds —

Fever heat — cholera —

Food — supply for it —

Excretion — Kidneys, Large Intestine

Indispensable — Liver — Lungs — Skin —

Muscles –

Voluntary & Involuntary & Mixed
red, striped – pale – banded –
quick – slow
heart – iris –

no change of bulk – shortening –
antagonist groups – galvan. – rigor m.

Levers – F. W P
Scales Crowbar Lift –
head foot biceps

Pulleys – eye & jaw – double levers –
Conditions of strength – good blood – [illegible] – exerc., repose.
Involuntary – Osoph – stomach – intest –
heart – bloodvessels – gland ducts – iris –

Mixed – swallowing – breathing – expression
oratory – acting –
Habitual automatic – walking – music
Stationary Calisthenics –

Blood

Liquid — Serum — corpuscles.
[diff. animals] Eases — Orgin
Coagulation — Ûses — diff. animals —
amount — Circulation —

H, a, C, V, (L. & Lac)

Heart —

Cavities — Sides — plan —
Size — muscle — beat —
valves — Sounds — rate
— figurative heart

Arteries

Locations — Coats — action
Hemorrhage, Spurtan, clip — treatment

10 in 1 sec. art.
10 in 3 sec. vein.

Capillaries

1 coat — variation — use forces

Veins

Coats — valves (result) — slow
1/2 minute all round —
Circuit — Dr W Harvey

Hygiene

Carbon, Hydrogen, Oxygen, Nitrogen, Sulphur, Phosphorus, Iron, Sodium, Potassium, Calcium, Chlorine, Fluorine.

Albumen, Fibrin, Gelatin, Myosin, Casein, Haemoglobin, Olein, Palmitin, Stearin, Neurin.

Atoms, Molecules, Cells, Fibres, Membranes, Tubes.

Connective, Fibrous, Elastic, Cartilaginous, Osseous, Corneous, Fatty, Dermoid, Mucous, Serous, Muscular, Nervous.

Alimentation, Circulation, Respiration, Reproduction, Excretion.

Sensation, Muscular Action, Intellection, Emotion, Will.

Tissues,

Connective

Fibrous { white
Yellow

Cartilaginous

Osseous

Corneous

Dermoid

~~Epithelial~~

Mucous

Serous

Glandular

Muscular

Nervous

~~Minute forms~~

~~Molecules~~ - Cells - Fibres - Membranes - Tubles

~~Formative~~
~~Substances~~ { veg. & animal.

nitrog
(Fibrin)

Albumen

~~Globulin~~

~~Chondrin~~

Ostein

~~Keratin~~

Myosin

Casein

Mucin,

& Color-matters — Of Blood, Eye, Skin,
Bile, &c.

&

Fatty

Olein

Palmitin

Stearin

Cerebrin

~~Products~~ —

Pepsin, Pancreatin, — Taurin — Urea &c

Carbon, Hydrogen, Nitrogen Oxygen

~~[illegible]~~ — Phosphorus — Iron
Sulphur
Calcium — Potassium — Sodium
Chlorine — Fluorine — Silicon

Tissues &c.

~~Elementary~~

Materials — (Elements)

Carbon — Hydrogen — Nitrogen — Oxygen.

Consumed together to

Carbonic Acid Water & Ammonia: &

(Sulph-hydrogen — Phosph Hydrog — Salts — &c)

Forces.

Gravitation — Heat — Light — Electricity

Chemism — Life force — Nerve Force.

Functions.

Vegetative:

Digestion — Circulation — ~~Nutrition~~ —

Respiration — Secretion — Reproduction.

Animal —

Sensation — ~~Spontaneous~~ Motion —

Intellection — Emotion —

Human — Will.

Tissues

minute Forms

Formation Substances

Products

Elementary Materials
&
Resulting waste Compounds

Forces

Functions

Alimentation.

Prehension — Mastication — Deglutition — Digestion [Salivary — Gastric & Intestinal] — Absorption — Assimilation — Nutrition.

Prehension: Amoeba — Tapeworm — Cuttlefish — Elephant — Butterfly — Mosquito — ~~Bee~~ Fly Beetle Bee — Tapir — Camel ~~Camelopard~~ Lobster — Fishes — Tortoise — & Birds [Bill — Claws — Tongue (woodp. — Hummgb.) Carnivora — Anteater — Chameleon — Apes & Monkeys — Man.

Teeth: ~~Clipping~~ & Rodent (Incisors) — Tearing (Canine) — Grinding (Molars) & Crunching (Molars).

20 first Teeth 8 incisors 4 canines 8 molars

32 Second Set 8 incisors, 4 canines, 8 Premolars, 12 molars

Temporal — Masseter and Pterygoid Muscles —

Parotid, Submaxillary & Sublingual. Glands.

Saliva — Pylorus
Gastric Juice Chyme
Pancreatic "
Bile
Intestinal " Chyle
Absorption
Capillaries
Lacteal Mesenteric Glands
Thoracic Duct
Assimilation
Liver
Spleen? Thymus
Lymph. Glands Thyroid Glands
(Cod Liver Oil)
(Circulation)
Nutrition — Formation
Special for each part. Growth Development Repair

Protoplasm

Prehension

Mastication

Milk

Alcohol

Digestion of different kinds of food:
1 Starchy - e.g.
2 Fatty - e.g.
3 Nitrogenous (Albuminoid)
(Bread & Butter)
Salivary & Pancreatic
Biliary & Pancreatic
Gastric & Intestinal
Variety necessary.
Rules: Eat thrice daily; Slowly; Chew; Cheerfully;
Stop when hunger is gone;
Rest after eating.
Eat when hungry - anytime

What we Breathe For?

Modes of Breathing in animals —
with gills, trachea, lungs (Birds)

Apparatus of respiration. Movements; insp & exp.

Costal & Abdominal Breathing

changes in the Air from breathing

Changes in the Blood —

Drowning — Suffocation

Foul Air — Ventilation - Disease

Croup — Asthma — Consumption

Animal Heat. Armpit 98.5° —

Blood 100° — Sheep 104° Arctic Fox 107°

Swallow 111° — Whale 100°

"Cold Blooded" animals —

Food for warmth

Clothing

Hardening —

Hemorrhage.

The Pulse.

Our Senses.
Sight, Hearing,
Taste, Smell
Touch, &
Muscular Sense.

Sound
&
The Ear.

Respiration &

animal
Heat.

(no notes on the
Circulation.)

Physiology of Hearing.

What is Sound?

Waves.

Travels 1090 to 1140 ft per sec.
(Light 186000 miles per sec,
Thunder & Lightning e.g.)

thro' air; 4 times faster, water,
10 times as fast pine wood.

Echo.

Tube ½ mile (Telephone)

Noise & Music.

16 vibra. up to 38000 audible.

High & Low sounds. Microphone.

Fundamental & Harmonics overtones. Octaves.

Anatomy of the Ear -
& uses of its parts. Deafness.

Taste

Smell

Touch

Muscular Sense

Sensation

Except vision

Eye & Vision.

Anatomy.

Blind spot — yellow spot —

Light — Waves — 7 rays — reflec — refrac.

colors - reflec — transmit — interference -

Law of refraction — lenses —

Retina — pupil — inversion of rays -

Unity of vision — opt. nerves —

Adjustment to distances —

Judgment of size & distance —

Sph. & chromat. aberration

Stereoscope —

Faults of vision

Nearsightedness — Longsightedness Oldsight

Astigmatism — amblyopia — asthenopia

Cataract — Strabismus —

Tears - eyelashes — eyebrows

Winking — Protected position of the Eye.

The

Eye

&

Vision.

Complementary
Interference
Tints,
VC

An acephalous and almost acardiac monster reported (Med. News, June 14 1884 p. 702) by Dr. to have been one of twins, and with a separate placenta of its own! the first so recorded with certainty. The monster's circulation was carried on by its own arteries.

N. B. this is my unhesitating explanation: not suggested in the paper above referred to.

Acardiac
fœtus with
Separate placenta!

Pulses of animals –
Red corpuscles of blood –
Great purpose of respiration, Oxidation –
for force (or energy), by Combustion –
vital, motor, & nerve force –
Reciprocal action of plants & animals –
1. as to air, 2 as to food & decay
Cycle of Nature – (fountain playing –)

Anatomy of human chest organs –
Mechanism of respiration –
Intercostals & diaphragm – bellows like –
Ext. & intern. intercostals –
Costal & abdominal resp. – Expiration –
Am't of air changed, & breathed in 24 hrs –
Ox. of 350 c. ft [7 ft cube] CO_2 = 8 oz charcoal
Changes in air breathed – 5 per ct. O lost, 5 per ct CO_2 more
& Watery vapor = nearly pint in 24 hrs –
Changes in blood – vice versa – & dynamized
Drowning – Asphyxia – Poisoned air –
charcoal gas – brewers vats – black hole –
Pélissier – mines – theatre in Glasgow – steamer in
Brit. channel – Experiments – lime water –
breath extinguish candle – House with lights –

Bellows —

~~Capillary siphon~~ —

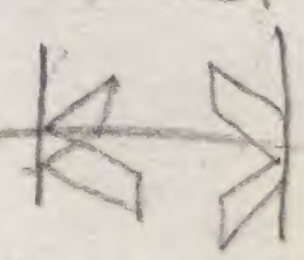
~~Sones from Bougery~~ -

~~Glass house & candles~~

(Candle to keep burning).

~~Glass vessel, candle~~
~~& tube~~ —

~~Bottle of limewater~~.

~~Blackboards~~ —
~~large for writing~~ -
& ~~small for~~ 

All animals and plants consist principally of
Carbon, Hydrogen, Oxygen and Nitrogen.

Plants take Nitrogen and Hydrogen (and also mineral substances) chiefly from the soil; carbon and oxygen chiefly from the air.

In the day-time (most) plants take carbonic acid gas from the air, and give out more oxygen than they take in.

At all times (nearly all) animals take oxygen from the air, ~~[illegible] or water,~~ in breathing, and give out carbonic acid gas.

Plants feed mainly on Carbonic acid, water and Ammonia.
Animals feed on plants or other animals; ultimately, therefore, the food of animals is vegetable matter.
Plants transmute dead, inorganic matter into living, organic matter.
Animals elevate vegetable substance into animal substance; and then, with waste, wear and tear, and decay, it returns to the state of inorganic or mineral matter again; — as Water, Carbonic Acid, and Ammonia, &c.
Thus the cycle of nature is complete.

Neill's arteries.

Chart of Lungs &c.

Old diagrams, — 3.

Bellows.

Miss Sawyer's blackboard views.

Subjects: Heart still: — slow pulse, —
& fainting —

structure,
Arteries, Capillaries & Veins —
valves — areas —
exercise —
~~velocity~~
Location — Ratio — Hemorrhage —
Portal circulation:
Discovery of Circulation —
Hygiene of vascular circulation.

Respiration.

General purpose — Oxidation; specially of carbon.

In plants; — lowest animals (cilia) —
insects — spiders — fishes — mollusca — worms —
Doris — oyster —
birds — mammals — Man. — amphibians — reptiles —

Anatomy — Mechanism — Quantity of air —

rate — changes of air — ch. of blood — Drowning — Hygiene —

Cavity, Iron — &c —

[illegible]

AMMONIA

STRIKES THIS

BLUE

COLOUR WITH

ARSENICAL GREEN.

AMMONIA

STRIKES THIS

BLUE

COLOUR WITH

ARSENICAL GREEN.

Complementary
Interference
Tints.

Complementary
Interference
Tints.

Complementary
Interference
Tints.

Complementary
Interference
Tints.

Complementary
Interference
Tint.

Complementary
Interference
Tint.

Complementary
Interference
Tint.

Complementary
Interference
Tint.

If after the removal of the whole cerebral hemispheres and ganglia, except the pons, sensations in warm-blooded animals still persist, as proved by the experiments of Vulpian, and more recently of Onimus, Lepine, Brown-Séquardand others; it appears to me legitimate enough to conclude that the vascular nervous centres, which are most numerous around the pons, are altered either directly or indirectly through peripheral sensory fibres. The nature, seat, and duration of any given irritation will determine the variety of diseased manifestations.

eases is of long duration, the peculiar shaking commo
to every form of sclerosis. This aspect of hysteria
as pointed out by Professor Charcot, is due to sec
ondary fasciculated sclerosis of the lateral column
of the spinal cord, which, however, he distinguishes
from what he has called amyotrophic sclerosis, by
the fact that in the last-named disease the cells of the
anterior horn of the spinal cord are primarily affected,
while in the hysterical wasting under consideration,
the cells become affected only as a consequence.
owever chron-

this he concluded that the work was done at the expense of the nitrogenous constituents of the body, which during the emergency were called upon to supply the extra fuel necessary for the production of an unusual amount of energy; and he believes that the muscle requires nitrogenous pabulum for its action, and that the mechanical work we do is performed at the expense of our nitrogenous materials, and not at that of our non-nitrogenous aliments.

It is of great importance that his results, which stand alone in contradicting modern views as to the metamorphosis which occurs in muscle during its activity, should be controlled by some independent observer repeating the experiments; and it is especially fortunate that an opportunity is now afforded of carrying on an investigation under circumstances so exactly similar to those enjoyed by Dr. Flint.

As Dr. Pavy does not give the total amount of urea excreted in twenty-four hours during a period of rest in his first observation of twenty-four hours' work, we can only compare the amounts per cent. under the various conditions. His results may be thus briefly reviewed.

Amount per cent. of urea in urine passed before starting (single sample)	2.561
Passed during first day's walk (100 miles)	3.365
Passed during second day's walk ($8\frac{1}{2}$ miles)	4.400
Passed one hour after twenty-four hours' walk	4.411

The actual amount of urea elimated during the twenty-four hours while walking was—

First day	1167.52 gr.
Second day	975.90 "

From this it appears that the amount of urea per cent. contained in urine passed during the walk was nearly double of that passed before starting—*i. e*, at rest: and the total amount eliminated in the twenty-four hours while walking is enormous for a man of Mr. Weston's weight.

The results of Dr. Pavy's second observation during Mr. Weston's seventy-five hours' walk are still more striking. The amount of organic constituents of the urine eliminated during the twenty-four hours before and after the feat being accurately estimated, as well as during the several days of exercise, the figures may be compared as follows.

Amount eliminated during the Twenty-four Hours.

	Amount of urea.	Other organic constituents.	Total.
Day before	640.67 grains.	92.87 grs.	733.56 grs.
First day	1057.20 "	297.69 "	1354.89 "
Second day	1196.33 "	355.66 "	1551.99 "
Third day	1128.55 "	61.28 "	1189.83 "
Day after	492.99 "	261.41 "	754.40 "

While the amounts eliminated during the days of rest accurately correspond with each other on this occasion, again the amount during the walking days is nearly doubled. These results appear to correspond with those arrived at by Dr. Flint. There seems, then, no doubt that—in the case of Mr. Weston, at least—an increase in the amount of urea and other organic constituents takes place during his walking feats. In drawing conclusions from this fact, it must be remembered how enormous the exertion is during these periods of activity, and how likely it is that an increase in the general tissue-metamorphosis occurs which would be sufficient to account for the unusual amount of nitrogenous material in the excreta. The question will, in all probability, prove to be whether the general disturbance of the system, as shown by the accurate observation of temperature, pulse, etc., would account for the excessive combustion of nitrogenous material, and not so much whether such excessive combustion does take place or not. The changes which occur during these extraordinary feats of endurance, then, would come under the title of pathological processes, and could not, therefore, be relied upon as a sure foundation upon which to base theories concerning the physiological changes which occur during muscular contraction under more ordinary circumstances of its activity. ~~If we~~

Only under excessive exercise are the ni-trogenous tissue-substances drawn upon. H.H.

seemed to prove that they could be reduced to the condition of young ones by removal of Hitzig's centre.

The paper is accompanied by various diagrams.—*London Med. Record*, Feb. 15, 1876.

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The Normal Digestion of Infants.

An essay by Dr. Wegscheider, of Berlin (vide *Centralblatt*, No. 3, 1876), based on the microscopical and chemical examination of the feces of a number of healthy infants between two and three months old, whose diet consisted entirely of breast-milk, reveals some interesting facts with regard to the various changes which go on in the digestive tract at the early period of life. The feces were simply scraped from the napkins, and then preserved, without the addition of water, in well-stopped bottles.

The colour of the motions of the healthy infants varies between that of yolk of egg and greenish-yellow; their reaction is always acid. Their consistence is very variable, and ranges from an almost completely dry to a thin liquid character. Their smell is never offensive, but resembles that of sour milk. The feces always contain whitish fibrinous-looking flakes, which are proved to consist of fat, with probably some intestinal epithelium. The fats consist of palmitin, stearin, and olein. Besides fat, the feces appear to contain traces of peptones. Sugar was not found in any appreciable quantity.

The remains of the secretion of the digestive tract are found in the feces in considerable quantity. Mucin is present in variable amount, and its presence can be chemically proved by the precipitate, insoluble in excess, which acetic acid produces in an aqueous solution. Bile-pigments exist, both free and in combination with bases. Choleic acid can be detected in a free state in a solution made by extracting the feces with alcohol. Cholesterin occurs in considerable quantity, but Dr. Wegscheider does not consider that it is entirely derived from the constituents of the bile. With regard to those bodies which are the products of transformation of the food and of the digestive secretions, neither leucin nor tyrosin can be chemically detected in the feces. On the other hand, large quantities of saponified fats, in combination with lime and magnesia, are present, and are thus wasted for nutritive purposes. In a watery extract of the feces Dr. Wegsheider found traces of diastatic and pancreatic ferments, but no pepsine. In consequence of the difficulty of keeping the feces free from admixture with urine, he did not examine them for urea.

The most important conclusions which Dr. Wegscheider draws from his researches on the feces of infants, in relation to their digestive functions, are the following: (1) The albuminous constituents of the milk are completely absorbed; (2) the white residue which is found in the feces, and is usually regarded as casein, is *not* casein, but chiefly fat, with some admixture of intestinal epithelium; (3) the unabsorbed fats leave the bowel partly as soaps, partly as free fatty acids, and perhaps partly as unaltered fat; (4) urobilin and unaltered bilirubin occur in the feces, and biliverdin is also found in diarrhœal stools.—*Med. Times and Gaz.*, March 25, 1876.

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The Excretion of Urea during Prolonged Exercise.

From Dr. Pavy's investigations (see *Brit. Med. Journ.* of Feb. 26th and March 4th and 11th) into the amount of nitrogenous excreta eliminated by Mr. Weston during two of his extraordinary walking feats, there appears little doubt that some increase in the amount of urea does take place during these periods of prolonged muscular exertion. It will be remembered that, by an elaborate series of observations upon Mr. Weston in America, Dr. Austin Flint found that while walking, the ratio between the amounts of nitrogenous excreta and ingesta became quite altered; the proportion of nitrogen eliminated, compared with the amount taken as food, being nearly double that excreted under ordinary circumstances, and that the excess of nitrogenous excreta corresponded with the loss of weight of the body. From

// THE MONTHLY ABSTRACT OF MEDICAL SCIENCE.
Vol. III. No. 4. (For List of Contents see last page.) April, 1876.

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MEDICAL SCIENCE.

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Anatomy and Physiology.

The Cause of the Coagulation of the Blood.

The experiments of Mr. Lister effectually disposed of all theories which ascribe the coagulation of the blood to the escape of a gas. He showed that blood might be poured through the air several times, so as to afford the freest opportunity for the escape of any gas, and yet remain uncoagulated for hours, provided it were kept in vessels formed of natural membranes. M. Glénard, in some experiments published last summer, corroborated very fully Lister's results; and asserted, in further disproof of any influence of gases on the coagulation, that blood inclosed in excised vessels might be plunged into any gas, including carbonic acid, without coagulation occurring. MM. Mathieu and Urbain, who a year ago advocated the opinion that the presence of carbonic acid was the immediate cause of the coagulation, have recently communicated to the Académie des Sciences some experiments in support of their preceding observation, and in opposition to Glénard's results. They urged that the influence of the normal vascular wall is relative and not absolute, and that it is less than M. Glénard supposes. It may be remarked that Lister, at any rate, maintains that the influence of the normal wall of a vessel is absolute in preventing coagulation; but that it is impossible to keep any part of a vessel in a perfectly healthy natural state under the conditions of an experiment; and that, in proportion to the change thus occasioned, the effect of the vessel is relative and not absolute. MM. Mathieu and Urbain go on to point out that coagulation may occur in the ligatured vessel of a living animal. They advocate, further, the influence of the presence of carbonic acid in causing coagulation, on the ground—first, that the coagulation occurs when the escape of carbonic acid is hindered by immersing portions of bloodvessels full of blood in a quantity of oil, or by placing them in an atmosphere of carbonic acid. Secondly, they repeat that a current of carbonic acid gas, passed through uncoagulated blood, determines the immediate formation of fibrinous clots, little coloured, similar to those obtained by whipping the blood; while, on the other hand, a current of air, of hydrogen, or of carbonic oxide leaves it fluid. They affirm, that, if the carotid artery or jugular vein of a dog, filled with blood, be suspended in a vessel of carbonic acid gas, coagulation will take place in three-quarters of an hour. They found that the vein of an ass, treated in a similar way, presented coagulation of the blood within it after two hours' immersion; while the blood, in a similar segment suspended in the air, was still fluid after the same time. Beneath oil, the coagulation was complete in three hours. Tubes composed of the intestines of birds yielded similar results. These conclusions are very different from those of M. Glénard, who found that, under identical circumstances, the blood was uncoagulated even after twenty hours. MM. Mathieu and Urbain admit, however, the occasional slowness of the coagulation of blood inclosed within an animal membrane and exposed to the action of an atmosphere of carbonic acid gas. The only explanation for this which they can offer is, that carbonic acid gas passes through the organic membrane of a vessel containing fluid less readily from without inwards than from within outwards; and, further, that the blood possesses the power of absorbing a considerable quan-

tity of this gas. In proof of the former assertion they took two identical bladders composed of organic membrane; one containing distilled water from which all gas had been removed, the other containing the same volume of water saturated with carbonic acid. The former was placed in an atmosphere of carbonic acid; the latter left exposed to the air. After half an hour the quantity of carbonic acid contained in each bladder was determined; and it was found that five cubic centimetres of carbonic acid had passed into the one, and fifteen cubic centimetres had passed out of the other. This assumes that the constant transudation of water through the wall of the bladder containing it so hinders the entrance of carbonic acid as to account for much of the difference in the two cases. In proof of the absorptive power of blood for carbonic acid gas, they found that 100 cubic centimetres of defibrinated blood absorbed 220 cubic centimetres of carbonic acid gas; while 100 cubic centimetres of serum absorbed 130 of carbonic acid gas. Thus the blood-corpuscles seem, in 100 cubic centimetres of blood, able to hold more than 90 cubic centimetres of carbonic acid. Previous researches had, however, shown them that it was only the carbonic acid contained in the plasma which effected the coagulation; and hence another element in the retardation of the coagulation, since it cannot occur in blood exposed to carbonic acid until the affinity of the corpuscles for the gas is satisfied.

M. Glénard, in a reply communicated a short time ago to the Académie by M. Bernard, reasserts his former position, that the influence of the vessels in preventing coagulation is paramount and irrespective of any relation to carbonic acid. Blood may be dried slowly in an isolated vessel without coagulation, and afterwards rendered fluid by moisture, still without coagulation. He further suspended by one end the segment of a vessel containing blood. The corpuscles soon sank to the bottom, leaving a colourless supernatant plasma. He opened the lower end, and allowed the lower portion, containing the corpuscles, to escape. He then replaced the corpuscles thus removed by pure carbonic acid. The plasma was thus brought into immediate contact with a large excess of carbonic acid; and there could be no question of absorption by the corpuscles or osmosis through a membrane. The two were thoroughly mixed, but not a trace of coagulum formed in the vessel.

This experiment appears to us, as it did to M. Chevreul, conclusive. It disposes effectually of the theory that the coagulation of the blood has any relation to the presence of carbonic acid. The experiments of MM. Mathieu and Urbain still remain to be explained, and are certainly worthy of careful repetition. We would suggest that some of their results may be explained by the influence on the wall of the vessel of the carbonic acid gas or of the oil in which it was suspended. The outer wall of a vessel exposed to an atmosphere of the gas may undergo changes which, extending to its inner wall, render the latter capable of determining the coagulation of the blood. In the experiment of M. Glénard this may not have taken place, because the gas, well mixed with liquid, came in contact with the inner surface, to which the mixture would be less foreign. It is with satisfaction that we find the experiments and conclusions of our own countryman thus fully corroborated, and we would only remark that the observations of Lister seem to have received less attention from the French experimenters than they deserve.—*Lancet*, Feb. 26, 1876.

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The Urine of New-born Infants.

The following are the conclusions of a paper presented by MM. Parrot and Robin to the Académie des Sciences (*Gaz. Hebd.*, January 14), "On the Normal Urine of New-born Infants, with Applications to Physiology and Clinical Medicine." 1. A new-born infant passes four times more urine than an adult, by kilogramme of its weight. 2. Under quite exceptional circumstances (as the urine of the first day, defective or faulty alimentation, etc.) the urine may furnish a very slight deposit, consisting of crystals of uric acid, of oxalate of lime, or urate of soda. Vegetable ferments seem to be more rapidly developed in it than in the urine of the adult. 3. It furnishes a neutral reaction with lit-

III. On Ocular Color-Spectra, And their Causation.

1. negative spectra – color spectra.

2. Color Shadows.

3. Complementary colors seen through thin paper.

4. Bright sun-spectra – & closed eye spectra & closed eye color-perception in sunlight; also, similar effects with magnesium light.

5. theory of saturation & neutralization – (interference: absorption?) to explain all these facts.

Ocular Color Spectra
& their Causation.

pendulum-vibrations must be absent from the notes examined; the resonators tell us that, in such cases, the corresponding simple tones are absent too. The simplest experiments of this kind are those in which a string is plucked or struck at the node of a given harmonic; in which case the existence of that harmonic vibration in the resulting motion is a mechanical impossibility: the corresponding simple tone is then found to be absent from the note. Again, theory indicates the absence of the harmonic vibrations of even orders from stopped organ-pipes; the corresponding tones are found to be absent.

The converse of these experiments is not so conclusive. Simple pendulum-vibrations are isolated by reinforcing the tone of a fork with a resonator, which rejects all accessory tones and strengthens the fundamental. The ear cannot then perceive any sensation of pitch except that due to the simple tone in question (p. 88).

Practically the certainty of the law depends partly upon the experiments on strings, and partly on the consideration that in numerous cases where a particular harmonic vibration is mechanically rendered prominent, the corresponding tone is found to be in a similar position musically.

At this stage Helmholtz introduces detailed investigations of the constitution of the notes of various instruments, principally of the pianoforte, of bowed instruments, and flute and reed organ-pipes. These investigations serve to illustrate the passage from Ohm's law to the fuller appreciation of the statement already mentioned, that quality of tone depends on the form of vibration. In fact Ohm's law reduces the varying forms of vibration to different arrangements of tones of the harmonic series, so far as the ear is concerned; and the discussion of the instruments serves to illustrate the general effect of the predominance of different groups of such tones. In estimating numerically the intensity of the different tones, Helmholtz employs the mechanical energy of the vibration as the measure (note to p. 122). This is clearly inadmissible, as Helmholtz himself remarks in the note on p. 17, and again at p. 264, where he gives an experiment which might be employed for the rigorous examination of the law of sensibility of the ear. I have shown some time ago that, if we admit that in similar organ-pipes similar proportions of the wind supplied are employed in the production of tone, the mechanical energy of notes of given intensity varies inversely as the vibration-number, a law in perfect accordance with the general indications of the experiment above referred to; and, admitting the correctness of the rest of the procedure in the calculation for pianoforte strings at p. 126, a considerable alteration would be introduced by the recognition of this law; but the whole calculation rests on hypotheses of an arbitrary nature, and the results do not pretend to any great accuracy. Moreover, the calculation is all based on the position of the hammer at $\frac{1}{7}$ of the length of the string from the end; I have found that in Broadwood's pianos the distance is very exactly $\frac{1}{8}$. The investigation of the motion of bowed strings is beautiful and interesting. With reference to organ-pipes I must point out that wide stopped pipes, which Helmholtz assumes to be very nearly simple tones, generally contain the twelfth in considerable intensity, as I shall show in the course of this article. Mr. Ellis has made a couple of small slips about organ-stops, which perhaps do not much matter; the name which Helmholtz writes "quintaten" is always written "quintatön" technically, and Hopkins is right, except in omitting the points (note, p. 50). The stop has nothing to do with the twelfth or duodecima; the quintatön is always stopped, and of 8 or 16 feet tone; the twelfth is always open and of $2\frac{2}{3}$ feet speaking length. Seidel gives the derivation "quintadena, quinta ed una," which appears to me as doubtful as Helmholtz's "quintam tenens." I have little doubt that the word arose simply from the remark that the stop had a "fifthy tone." Again (note p. 273), the cornet is suggested as the English equivalent of the violin stops; the cornet was an old-fashioned mixture, quite unsuitable for this purpose: the keraulophon or gamba would be more to the point.

The discussion of the notes of various instruments enables us to form a distinct idea of the nature of the dependence of quality of tone on the harmonics present. Some have supposed that, as all ordinary notes have the same harmonics, all must, according to this law, have the same quality of tone. The error here consists in the ambiguity of "same harmonics." The harmonics of musical notes all belong to a certain series, but each separate harmonic can vary from a great intensity to none at all. Suppose, for instance, we have, as in large stopped pipes, only the fundamental and 12th sensible; the intensity of the 12th may vary from about twice that of the fundamental to a small fraction of it, according to the scale and voicing of the pipe: and the quality varies accordingly. Much more when the first eight or more partial tones are present, can we by varying the intensity of all, separately or in groups, conceive of the production of infinite varieties of quality. That the 7th tone is generally present in considerable strength is shown by the dissonant effect of the common minor seventh, and the cessation of beats when it is flattened into the harmonic seventh, which Mr. Ellis calls the subminor seventh.

The theory of vowel qualities of tone is one of the most important parts of the book, and it is not very easy to form a correct idea of it. It has been the subject of considerable animadversion lately, and it would require a separate article to deal with the subject with any completeness. We may observe, however, that, if it be true that all quality of tone depends on the arrangement of the harmonics present, this must be true for vowels as well as other sounds. We may take it that Helmholtz reduces the influence of the oral cavity to two elements: a characteristic pitch of resonance, and what he calls a "Grad der Dämpfung" (degree of extinctive power). In the summary at p. 740, Mr. Ellis appears to me to overlook this latter element. The result of it is that different forms of the oral cavity act differently on tones at a certain distance from the pitch of principal resonance. The forms with nearly closed mouth approximate to a tuning-fork in this respect, and strengthen only tones closely coincident with the pitch of principal resonance, but these strongly; while forms with open mouth extend their strengthening power to a considerable interval on either side of the principal resonance, but that power is not so great. The determinations made by Helmholtz chiefly refer to the pitch of principal resonance of the oral cavity; they establish the point that this pitch is definite and constant for any particular vowel. The completion of the investigation would, it appears to me, require the determination of the position and intensity of the constituent harmonics for all the vowels, sung on different notes of the scale. The direct determination is far beyond the power of experiment as yet, but determinations of the extinctive power and pitch of the resonant cavity would enable us to arrive by calculation at a result not far from the truth. The objections that have been raised seem to me to consist, as usual, in a misapprehension of Helmholtz's statements. If we take the table of principal resonances for the different vowels (p. 163, 1st table, 3rd col.), and reduce Helmholtz's carefully-guarded enunciation (p. 165) to the bare statement that tones of the pitch indicated are characteristic of the different vowels, we have a position absurd in itself and foreign to Helmholtz's views. R. H. M. BOSANQUET.

A Grammar of the Arabic Language. Translated from the German of Caspari, and edited, with numerous Additions and Corrections, by W. Wright, LL.D., Professor of Arabic in the University of Cambridge, and Fellow of Queens' College. Second Edition, Revised and Greatly Enlarged. (London: Fr. Norgate, 1875.)

To write a grammar adapted to the genius of another language, easy in method for the beginner as well as complete enough for the advanced scholar, is a difficult task in the case of any language. The difficulty is much greater in the composition of a grammar of an Oriental language, more especially a Semitic, the genius of which, both in its etymology and in its syntax, differs so completely from our own. For Hebrew, Chaldee, Aethiopic, and even Syriac, the literature of these languages being comparatively small, a grammar, as regards the examples necessarily quoted in it, is less difficult to compose than for Arabic, which can rival any other language in the vast extent of its literature. The translation of a native grammar for use in our schools would only help to disgust the few who occupy themselves with Oriental studies. These grammars, indeed, bear much resemblance to those mediaeval Latin grammars where the rules are laid down in a kind of bad hexameter, and which can only be understood with the help of a commentary. However, if we cannot adopt them as models, yet with all their complications they cannot be neglected by any one who writes an Arabic grammar which has to contain more than the paradigms of verbs

had not done before—I find he gives the same general meaning: "Then (in the days of Almeria's greatness), according to the proverb, Granada was *merely* a farm." It is rare, in this kind of *dictons*, that one town compliments its neighbour; it is far more often the reverse. There is generally an exaggeration of one's own merits, and an equal disdain of other people's. Almeria is, as it were, the speaker here, and therefore I give to "alqueria" the most contemptuous meaning it will bear.

WENTWORTH WEBSTER.

The EDITOR *will be glad if the Secretaries of Institutions, and other persons concerned, will lend their aid in making this Calendar as complete as possible.*

APPOINTMENTS FOR NEXT WEEK.

SATURDAY, Dec. 4,	3 p.m.	Crystal Palace Concert (*St. John the Baptist*).
	,,	Saturday Popular Concert, St. James's Hall.
	3.15 p.m.	Alexandra Palace Concert (*Messiah*).
MONDAY, Dec. 6,	3 p.m.	Asiatic.
	5 p.m.	Musical Association: "On the Graphical Representation of Intervals," by Dr. W. Pole.
	8 p.m.	Society of Arts: Cantor Lecture.
	,,	Civil Engineers. Medical.
	,,	Monday Popular Concert, St. James's Hall (Mdme. Essipoff, Wilhelmj).
TUESDAY, Dec. 7,	8.30 p.m.	Zoological: Papers by Professor Owen, Mr. J. W. Clark, the Rev. R. Boog Watson, and Dr. H. Burmeister.
	,,	Biblical Archaeology: Notice of a very Ancient Comet, from a Chaldean Tablet," by H. Fox Talbot; "On Babylonian Augury by Figures and Geometrical Signs," by the Rev. A. H. Sayce; "On the Assyrian Belief in the Immortality of the Soul," by W. Boscawen; "On the first Sallier Papyrus," by Professor E. S. Lushington; "On Two Ancient Maps of the Holy Land," by S. M. Drach.
WEDNESDAY, Dec. 8,	3 p.m.	Literary Fund.
	3.30 p.m.	Mdme. Essipoff's Second Recital (St. James's Hall).
	8 p.m.	Society of Arts. Graphic.
THURSDAY, Dec. 9,	8 p.m.	Historical: "The Siege of Quebec," by Sydney Robjohns; "Two Bohemian Romances of the Fourteenth and Fifteenth Centuries," by the Rev. A. H. Wratislaw.
	,,	Mathematical: "The Transformation of Elliptic Functions," by Professor Clifford; "On a System of Algebraical Equation," by Professor Cayley; "On a Problem of Eisenstein," by Professor H. T. S. Smith.
	,,	Inventors' Institute.
	8.30 p.m.	Royal. Antiquaries.
FRIDAY, Dec. 10,	7.30 p.m.	Sacred Harmonic Society, Exeter Hall (*Deborah*).
	8 p.m.	New Shakspere Society: "On the Dedication of Shakspere's Sonnets," and "On Shakspere's Use of the word *Season*," by Dr. C. M. Ingleby; "On the Play of *Edward the Third*," by F. J. Furnivall.
	,,	Astronomical. London Anthropological. Quekett.

SCIENCE.

The Sensations of Tone as a Physiological Basis for the Theory of Music. By Hermann L. F. Helmholtz, M. D. Translated, with Additional Notes and an Additional Appendix, by Alexander J. Ellis, B.A., F.R.S. (London: Longmans & Co., 1875.)

(*First Notice.*)

THE publication of this work in German in 1862 formed an epoch in the science of music. Although it has, since that time, been recognised by most scientific men who interest themselves in the subject as affording, for the first time, an intelligible basis for the investigation of the material which musicians have to work with, it has hitherto been known to the English musical public almost exclusively through the medium of such works as Tyndall on *Sound*, and Sedley Taylor on *Sound and Music*. The account given in these works was necessarily incomplete, owing to their small extent; and now we have to thank Mr. Ellis for a laborious and for the most part extremely accurate translation, accompanied by a valuable collection of collateral information on points connected with the subject. It is to be regretted that the high price of the volume may be likely to stand in the way of its general diffusion among professional musicians.

We are struck at the outset by the improvement effected by Mr. Ellis in the translation of the technical terms. He discards Tyndall's half-German forms, such as clang, clang-tint, overtone; and replaces them by others which are at least English, if not quite the best possible. I should prefer the adoption of the late Professor Donkin's proposal to use the word *note* for the German *klang*; Mr. Ellis uses *compound tone*. *Clang-tint* makes way for *quality of tone*; and *overtone* is generally replaced by the expression *upper partial*: *upper tone* would be preferable if *overtone* is objected to; I do not see the force of the objection. *Ground tone* is replaced by *prime tone*; I do not see the object of discarding the better-known term *fundamental*. The term *harmonic* is employed in the sense of *harmonious*; this is objectionable, as the ordinary meaning is so universally accepted, and is not covered by any of the previous expressions.

The work of Helmholtz is divided into three principal parts: on the Composition of Vibrations; on the Interruptions (Perturbations, *Störungen*) of Harmony; and on the Relationship of Musical Tones (Notes, *Klänge*). The two first divisions comprise the physical investigation; the third aims at the foundation of an aesthetic system based on the previous enquiry, and comprises a historical dissertation of great research and interest, and a discussion of the principles of harmony, chiefly from the point of view of just intonation.

In dealing with the physical work it will be desirable to point out as clearly as possible the division of the argument between experimental evidence and theory. A portion of the statements of Helmholtz rest upon mathematical or mechanical bases; unless these are discriminated the ordinary reader is puzzled as to certain points, for which he thinks he ought to see the reason, when in truth the evidence may be contained in some mathematical demonstration. The demonstrations unfitted for the general reader are collected in the Appendix, but of course they do not contain everything; and, indeed, little trouble has been taken to make them accessible to persons possessing only a slight knowledge of mathematics.

In the first part, after the introduction of the conception of a wave, the proposition is demonstrated that quality of tone depends on form of vibration. The inference is made to depend on an exhaustive process. It is, like most general reasoning, scarcely conclusive in itself, but furnishes suitable foundation for more rigorous proof. After the application of the principle of the superposition of small motions, follows that of Fourier's Theorem. Translated into ordinary language, this may be stated as follows:—Any periodic motion whatever can be represented as a sum of pendulum-vibrations, whose vibration-numbers are integral multiples of that of the given motion. This is, in its abstract form, not a mechanical law, nor an experimental observation; it is a statement involving only laws of number and geometry, and it can be verified in any particular case by an arithmetical process involving little greater complexity in principle than the consideration that two and two make four. Of course the proof in the general case is a more recondite matter. The statement that any periodic motion will act mechanically, under certain circumstances, as if it were such a sum of pendulum-vibrations, is a further step, and rests on the known mechanical theory of such matters. We may advance the demonstration to this same point by direct experiment in particular cases; and for those who are incapable of appreciating the mathematical demonstration the experimental treatment furnishes an assistance; but such experiments can prove the point only subject to the arrangements and conditions under which they are conducted. The problem in question is that of analysis of vibrations by sympathy. At present we are only speaking of vibrations, not of tones. Perhaps the most striking experiment applicable to this particular point is described by Professor Mayer;* an account of it is given at page 699 in the translator's Appendix. The complex vibration of a reed-pipe affects a leather surface which is connected by silk threads with eight tuning-forks, tuned to the fundamental and harmonics of the pipe. So long as the tuning was quite accurate, the forks were all excited by the sounding of the pipe; but the slightest deviation in the tuning of any fork silenced it. As the forks only execute pendulum-vibrations,† the experiment proves that the periodic vibration arising from a reed-pipe is capable of exciting pendulum-vibrations corresponding to the harmonic series, and no others.

The next step in the argument is, as it seems to me, the crucial point of Helmholtz's theory, by which all the rest must stand or fall. It is the law of Ohm, which may be thus enunciated:—Simple pendulum-vibrations in air, whether existing separately or potentially in a complex periodic motion, affect the ear with the sensation of simple tones, having their pitch determined by the periodic times of the pendulum-vibrations. The demonstration of this law is necessarily experimental, for it involves physical phenomena not included in our fundamental mathematical or mechanical knowledge.

The experimental detection of the presence of simple tones in complex masses of sound, is much facilitated by the employment of resonators. First, in proving Ohm's law, we say: under certain circumstances the mechanical theory tells us that certain

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* Professor of Physics in the Stevens Institute of Technology, Hoboken, New Jersey, U.S.

† This is only true to a first approximation, but that is sufficient for this experiment.

PERCEPTION OF MUSICAL TONES.—From the researches of Prof. Preyer, of Jena, on the "Limits of Perception of Musical Tones," it appears that the minimum limit for the normal ear is from sixteen to twenty-four vibrations per minute, and the maximum forty-one thousand vibrations, though persons with average powers of hearing were found to be absolutely deaf to tones of sixteen thousand, twelve thousand, or even fewer vibrations.

and indict him before two magistrates; if they decide him to be guilty of madness, he may be put to death. We should think vacancies would abound in the York County Police towards the close of the dog-days.

NEW TEST FOR ALCOHOL.—At a meeting of the Royal Irish Academy, Dr. Edmund Davy read a paper on a new chemical test for alcohol. One part by weight of molybdic acid added to ten parts by weight of sulphuric acid

Use of Salicylic Acid in Diphtheria.

Dr. H. SCHULTZE, of Ehringshausen, communicates to the *Allgemeine Medicinische Central-Zeitung* for February 16, a contribution on the use of salicylic acid in diphtheria. He says that he has given it in two cases of scarlatinal sore-throat in children aged ten and twelve years, and in twelve cases of primary diphtheria in twelve children aged from one to eight years. In the two scarlatinal cases, and in some of the others, there were extensive deposits in the fauces and adjacent parts, extending to the glottis and nares. These cases were treated twice or three times daily in the following manner. As much salicylic acid as possible was taken up on a moistened brush, which was then applied carefully to the affected parts. In some cases it was necessary to leave the carrying out of this treatment to the attendants, after they had been shown how to do it. At the same time salicylic acid was given internally, in combination with mucilage and water. The result of the treatment in ten cases in which it was employed was, that in some the diphtheritic exudation was diminished on the first day, the general symptoms in all were improved, and in some cases it was necessary to continue the local application after the fifth day. At this time the mucous membrane of the fauces was either more of a red colour, or was coated in some parts with a very fine bluish-white layer, not due to diphtheria, but, as Dr. Letzerich has pointed out, to an effect of the action of the salicylic acid on the epithelium.

In one case (a girl, aged eight), the treatment failed to arrest the formation of diphtheritic membrane, which became very extensive and thick, so that it was necessary to remove it. The patient recovered.

In three cases the diphtheria was confined to the larynx, the symptoms being those of obstruction of the part. Dr. Schultze gave salicylic acid in mixture; but in two instances the symptoms were so severe that he performed tracheotomy; both children died. The third child probably recovered; it resided in an elevated and isolated locality, and perhaps suffered only from laryngeal catarrh.

The result of the two cases of primary laryngeal diphtheria show how powerless we are in this affection, even with salicylic acid.—*London Medical Record*, May 15, 1876.

The Physiological Pathology of the Brain.

The subject of Localization of Function and Disease in the Brain has attracted considerable attention since the discovery of Fritsch and Hitzig. The admirable lectures of Professor Charcot at the School of Medicine of Paris, and the researches of Dr. Brown-Séquard, the results of which have been communicated by him to several medical audiences in Boston and in Paris, have clearly shown the practical aspect of the study. Knowing that Dr. Brown-Séquard intends to deliver lectures in several parts of England this summer on the subject, it may be well to give a summary of the new views of that physiologist.

According to the beliefs universally entertained, the left side of the brain is the centre for volition and movements of the right side of the body, and, *vice versâ*, the right side of the brain for the left side of the body. It is also admitted that one side of the brain contains the centres for the organs of sense of the other side, with the exception that (according to Wollaston's views) the centre for the outer half of the right retina, and that for the inner half of the left retina, are on the right side, and *vice versâ* for the other halves of the retinæ. Dr. BROWN-SÉQUARD believes that all these fundamental views are absolutely wrong. He has collected a large number of facts which prove, according to him, that each half of the brain has two sets of conductors, one going to the right half of the body, and the other to the left half. He believes that it is so, not only as regards voluntary impulses and common sensations, but also for the various senses. In other words, he contends that each half of the brain is perfectly sufficient for all the actions of muscles, of sensitive nerves,

and of the organs of sense, on the two sides of the body. Of course, he is fully aware that every day physicians have under their eyes facts which seem to contradict this view. It is a matter of most frequent observation in the practice of a physician to see a patient who has lost the power of motion and sensibility in one half of the body from disease in the opposite half of the brain. He argues that the question is not whether such a fact contradicts or not his view, but whether that fact is or is not to be explained by admitting that the paralysis and anæsthesia are dependent upon the destruction of a centre or of the conductors for voluntary movement and sensation. There lies the vital point in the new views of Dr. Brown-Séquard. He has accumulated facts which he believes negative the theory that paralysis, anæsthesia, amaurosis, aphasia, and other effects of brain disease depend on a loss of function of either the centres or conductors specially employed in voluntary movements, perception of sensations, power of expressing ideas by speech, etc. Dr. Brown-Séquard endeavoured to prove, for the first time, in his Gulstonian Lectures delivered at the College of Physicians in 1861, that a lesion of one limited part of the brain may produce any symptom; and that, on the other hand, the same symptom may appear, no matter where the seat of the lesion may be. Facts of these two kinds are alone sufficient to show that we are not to look upon symptoms as manifestations of the putting in play of a property, or as direct results of the loss of function of the part diseased. But there are many other arguments brought forward by Dr. Brown-Séquard to establish his proposition that the origin of brain symptoms is not what it is believed to be.

If we take, for instance, the history of paralysis, we find—1. That a lesion in any part of the brain can produce paralysis either on the same side or on the opposite side of the body.[1] 2. That paralysis can often appear and disappear although the lesion causing it is a permanent one. 3. That there is no relation whatever in many cases between the extent of a lesion and the degree and extent of a paralysis. 4. That a paralysis may be brought on suddenly, whereas the lesion causing it has existed for some time already, or appear gradually and slowly, although the lesion is a sudden one. 5. That a paralysis can appear on one side, then on the other side, although the lesion remains in one half of the brain. 6. That a paralysis can appear in the arm on one side and in the leg on the other side, from a lesion in one side of the brain. 7. That paralysis can strike three limbs from a lesion in one side of the brain. 8. That paralysis can strike the two lower limbs or the two upper limbs alone from a lesion in one half of the brain. 9. That paralysis can appear in one half of the body from a lesion involving equally the two sides of the brain along the middle line. 10. That paralysis may appear in a few muscles only, either in the face, or the trunk, or the limbs, from a disease above the pons Varolii. 11. That a paralysis of the sphincters of the bladder, or of the anus, may result from disease in any part of the brain. 12. That the so-called altern paralysis may appear from a disease above the pons Varolii. 13. That hemiplegia, when complete, is almost always accompanied by some paralysis on the other side, although the producing disease exists only in one half of the brain.

If we examine what relates to convulsions, we find, according to Dr. Brown-Séquard, that what is seen for paralysis is seen also for spasmodic movements. We will point out here this interesting fact, that a lesion in the right side of the brain can produce convulsions indifferently on the right or the left side of the body, while a lesion in the left side of the brain, if it does produce unilateral convulsions, will cause them to appear almost always on the right side.

As regards vision, facts show that a disease in one half of the brain can produce hemiopia either in both eyes or one, and in the corresponding or the opposite halves of the retinæ, or a complete amaurosis of either of the two eyes, or of both together.

As regards other symptoms, such as anæsthesia, aphasia, loss of consciousness, etc., Dr. Brown-Séquard endeavours to show that they also may arise from lesions in almost any part of the brain.

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[1] See Dr. Brown-Séquard's Lecture in The Lancet, January, 1876.

Considering the immense variety of phenomena originating from a lesion in one and the same part of the brain, and in presence of facts showing that any limited part of the brain can be destroyed without loss of function, Dr. Brown-Séquard has come to the conclusion that symptoms take rise, not from the loss of action of the diseased part, but from an influence exerted on distant parts of the nervous system by a lesion limited to a part of the brain. He considers the appearance of symptoms as depending on essentially variable conditions of excitability of the nervous tissue round diseased parts. He is convinced that it is impossible to sustain the old theory called the clavier theory, and that we must, on the contrary, admit that a few fibres alone are sufficient to establish full communication between the cells of the spinal cord and the cells of the brain. He holds that there are two sets of conductors, one decussating and the other direct, between each half of the brain and the spinal cord. He maintains that the seat of each special function of the brain, instead of being, as admitted, a cluster of cells localized in a small part of the brain, is disseminated, so that the cells belonging to each are spread over a considerable extent, if not the whole extent, of the brain. He states that there is no more difficulty in admitting that cells that are at a distance of many centimetres one from the other can communicate or act together, than to admit that they can have intercourse when they are at a distance of half a millimetre or less from each other. He believes that symptoms of loss of power, such as paralysis, anæsthesia, amaurosis, aphasia, etc., are due altogether to an inhibitory influence exerted on cells, some near, others far or very far from the place of the lesion. For him, whether amaurosis affects both eyes from a lesion of the spinal cord, or of a sensitive nerve, or of the brain, it is owing in all these cases to an inhibitory action on visual cells, either in the two sides of the brain, or in the retina, or in both parts. Again, if aphasia appears when there is a disease in any part of the left side of the brain, either the third frontal convolution, or the insula, or any other, it is owing to an inhibitory influence exerted on cells serving to the expression of ideas by speech, wherever these cells are located. We repeat that paralysis and anæsthesia also appear, by a similar mechanism of inhibition, wherever the disease producing these symptoms may exist.

In respect to the group of symptoms consisting in a morbid activity in cells of the brain, what takes place on the occurrence of those symptoms is a setting in action of normal properties by an exciting cause. So that either here, or as regards the phenomena of cessation of an activity, the same cause primarily exists—an irritation.

Dr. Brown-Séquard has no doubt that the old theories must be given up. He is sanguine as regards his power of demonstrating that a great part of his new views is already established by facts, but he acknowledges that some portion requires additional corroboration. He hopes that others will help him in the demonstration of the correctness of his views, or show him in what he is mistaken, and his object in delivering his lectures in England is precisely to have that help or that criticism.—*Lancet*, June 3, 1876.

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Apoplexy of the Spinal Cord.

Dr. E. Goltdammer, of Berlin, reports (*Virchow's Archiv*, Jan. 1876) the following case of hemorrhage into the substance of the cord, an affection of rare occurrence, except when of traumatic origin. The greater number of the cases of effusions of blood registered were caused by myelitis, while in nearly all of the remainder there could be found no trace of any inflammation. The latter are therefore generally considered as spontaneous apoplexies, *i.e.*, caused by non-inflammatory malacia. Such a case came under the notice of the Doctor.

The patient, a girl of about sixteen years, was suddenly attacked with a severe pain in her back between her shoulders, which soon passed over to her right, and after a while, to her left arm. She also noticed a pain in the pit of her stomach, and found somewhat later that she could not move her right leg. Having been sent to the hospital, the examining physician found complete

paraplegia, complete anæsthesia up to the mamillæ, and paralysis of the bladder, while the reflex action of the lower extremities was still intact; her temperature was normal, pulse 80; did not show any brain symptoms, but complained of pains in both arms. A few days afterwards the abdominal and dorsal muscles proved to be paralyzed, and percussion of the spinal processes of the dorsal vertebræ caused her pain. The pulse was 96; her bowels moved only when drastics were given her. A slimy discharge from her vagina was noticed. The case was considered as hemorrhage into the spinal cord below its cervical enlargement. The treatment consisted in local depletion, in the methodical use of the ointment of mercury and in the use of drastics. The patient, having improved in general very little, died from decubitus about a year after the attack. The most noteworthy observations made on autopsy are the following: The uterus was small; upon the left ovary there was observed a little cicatrix, beneath which there was a yellow-brown substance as large as a pea imbedded in the stroma; about one inch below the cervical enlargement of the spinal cord there seemed to be a compressure of the medulla; a cross section through this part showed that its original diameter was reduced very much, and that the right lateral column and the adjacent parts of the anterior and posterior columns, as well as the gray substance between, were occupied by a rusty brown substance of callous consistence. The microscopic examination of this proved that it was formed of *connective tissue* inclosing fatty matter, crystals of hæmatoidine and a granulated brownish pigment; the vessels in this part had undergone fatty degeneration, their walls were thickened, and contained brown pigment; *no nervous elements* could be found in this substance; its entire length was about one-tenth of an inch. The adjacent parts of the medulla were *not degenerated* by softening, only a few rusty stripes and a yellowish colour were noticed on their examination; the whole remaining cord was found to be intact. As no symptom speaks for myelitis as a casual element in this disease, it could only be caused by an effusion of blood into the substance of the cord: the latter probably had been provoked by suppression of the menses, for the heart and the vessels, especially those of the spinal marrow, were intact, and no injury had occurred to the patient. It is true that she stated she never had had her monthly nor noticed any molimina, in spite of her age and bodily development. There were, also, no signs of menstruation noticed during her sickness. But there was revealed by autopsy the presence of a corpus luteum of the size of a pea, and certainly of a longer standing, and a slimy excretion from her vagina was observed a few days after the attack. These facts favour strongly the above-mentioned suggestion.—*Detroit Review of Med. and Pharm.*, June, 1876.

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On the Treatment of Chorea.

M. Fabry relates in the *Bulletin de Thérapeutique* (quoted in *Paris Médical*, March 9, 1876) some observations carried out in the service of Dr. Perroud, of Lyons, on the treatment of chorea by ether-spray. This therapeutic agent, employed for the first time in 1866 by Lubetski, has given good results in Dr. Perroud's hands.

Applications of ether-spray are made along the spine by some spray-producing apparatus, such as those of Richardson or Marinier. Each application lasts from four to eight minutes. At the commencement of the treatment applications should be made three times a day; afterwards the number may be reduced to two.

Ice produces the same effect as ether-spray; a piece of ice may be passed along the length of the vertebral column for five minutes at a time.

These two means have effect by their refrigerant revulsive action on the excito-motor point of the nervous centres.—*Lond. Med. Record*, May 15, 1876.

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Notes of a Fatal Case of Chorea Gravidarum.

Dr. Alex. R. Simpson, Prof. of Midwifery in the University of Edinburgh, reported to the Obstetrical Society of Edin. (*Obstetrical Journal of Great*

He assists the delivery power by grasping the uterus, keeping it contracted, and employing cord contraction with a pendulum movement. After delivery of the placenta he secures contraction of the uterus by pressure. In his view persulphate of iron injections were not necessary.

DR. WILSON, of Pennsylvania, in a case of irrepressible hemorrhage, continuing several days after labor, had resorted at last to iodine. The uterus, although only three or four drops were injected, at once contracted, and remained so.

DR SIMS did not think the sulphate of iron in hemorrhage was quite as popular in London as formerly, on account of the deaths from septicæmia. In an alarming case in his own experience, he had wrapped cotton saturated with solution of the sulphate around a pointed piece of whalebone, and at once arrested the hemorrhage when it was introduced. Tampons should be removed as soon after the arrest of hemorrhage as possible. When you take away the cotton, as above described, you take away the greater part of the sulphate.

DR. SIMS was anxious that the treatment of the pedicle in ovariotomy should be the subject of the first day's discussion at Chicago, and he now threw down the gauntlet to the Dr. Atlee and other gentlemen for that purpose.

DR. BUSEY'S Address was then, on motion, refered to the Committee on Publication.

DR. GARRISH, of New York, referred to the desirability of inducing premature labor in cases of threatened convulsions, of physicians carrying with them in their practice a laryngoscope and ophthalmoscope, etc. The prematurely born child should not be dressed, but placed in a warm bath, and afterwards wrapped in cotton.

The Section then adjourned *sine die.*

NEW YORK MEDICAL JOURNAL ASSOCIATION.

Stated Meeting, June 2d, 1876.

DR FRANK P. FOSTER, VICE-PRESIDENT, IN THE CHAIR.

ON THE PHYSIOLOGY OF THE BRAIN.

DR. EUGENE DUPUY delivered an interesting lecture upon certain points in the physiology of the brain, which may be summarized under the following heads:

First.—Nerve cells not only deserve attention as centres, but also as conductors. Hence the explanation of the fact that a lesion might be located far from the would-be centre of the localizers, and yet produce the same symptoms, and *vice-versa.*

Second.—Nerve cells were not permanent. The only permanency about them was the power to develop properties—by heredity and by acquisition—hence the "suppliance theory."

Third.—In the experiments of Hitzig and others, the irritation by electricity did not act on the cortex, which was not irritable, but upon vascular nerves, which, from the pia mater at the spots where electricity generally gives rise to contraction, enter into the convolutions, either alone or along the blood-vessels, whose arrangements were peculiar, but which went beyond the thickness of the cortex, and the strands of nerve fibres, which, after forming the crura cerebri, distributed into the crown of Reil and the internal capsule, etc., were the continuations of the true spinal cord at

those points. A difference in the mode of supply of blood to the different territories of the cortex explained the difference in results obtained by irritation. (See Dr. Dupuy's paper in Soc. de Biologie of Paris, in *Gaz. Médicale de Paris*, 1875, pp. 376 and 600, and those of Roche-Fontaine, *id.* pp. 565 and 648.)

Dr. Dupuy believed that his vascular theory, advanced some time ago, derived support from the very recent researches of Brown-Séquard, Eulenburg and Landois, and others.

Dr. Mary Putnam-Jacobi suggested the following consideration in connection with Dupuy's statement regarding latent power in nerve cells. We were aware that it was impossible to entertain any idea without having first passed through a series of preparatory states of mind; that it was impossible to have an impression without being previously submitted to a number of impressions, which graded into each other according to a definite line of succession. The question then became, whether that succession of ideas or succession of impressions was connected with the gradual growth of ganglion cells, each group corresponding to an impression, or each one corresponding to a fragment of an idea or impression? If so, the psychological problem, practically or theoretically, was connected with the nutrition of the brain, with generation of the ganglion cells, which must be presumed to follow a definite line of descent and inheritance.

Dr. Dupuy stated that he would speak upon that point in a future discourse.

The subject of Dr. Dupuy's remarks was further discussed by Drs. McIlvain, Peters, Hamilton, and Foster.

Correspondence.

UNUNITED FRACTURE OF UPPER END OF FIBULA.

UPPER FRAGMENT DISPLACED BY ACTION OF BICEPS, AND CONSEQUENT INJURY OF THE EXTERNAL POPLITEAL NERVE.

Prof. Hamilton, to whom the history of the following case was sent, writes:

The case related in the accompanying note is of special interest. The fracture of both bones of the leg at this point is unusual. The refusal of the fibula to unite, on account of the contraction of the biceps, suggests the propriety of flexing the leg in treating such a fracture, or of dividing the biceps at once.

The hyperæsthesia, pain, and paralysis of certain portions of the foot is plainly due to some injury inflicted upon the external popliteal nerve, probably by the pressure of the upper fragment; and I have said to the doctor that the biceps ought to be divided, or the upper fragment of the fibula dissected. Yours truly,

Frank H. Hamilton.

43 West Thirty-second Street.

Prof. F. H. Hamilton,

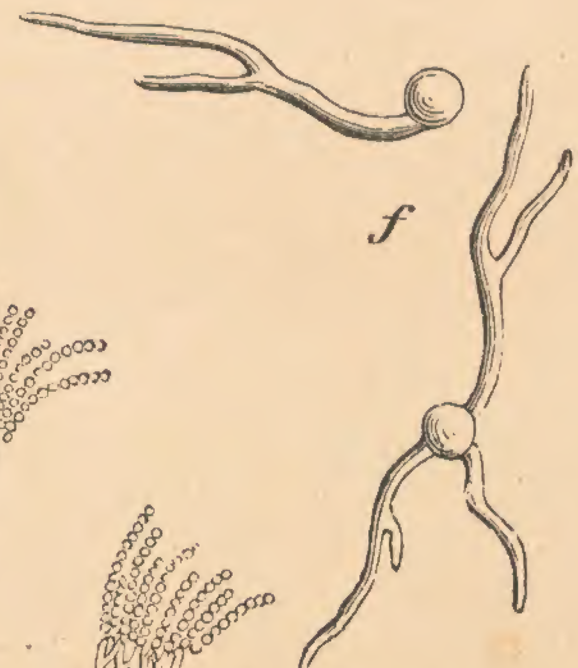
Dear Sir:—Having sustained a fracture in my own person, resulting, in part, in non-union and slight deformity and disability, and not finding a record of any similar case in your Fractures and Dislocations, nor in any other work we have here, I have considered it of sufficient importance to communicate it briefly to you. The injury occurred by being capsized while riding in my covered buggy, and being dragged un-

Vaso-Motor Centres and their Mode of Action. —Masius and Van Lair (Congrès de Bruxelles, Sept., 1875) agree with the theory of Goltz regarding the existence of vaso-motor centres. The conclusions to which they have arrived may be stated as follows: In a physiological point of view, the vaso-motor apparatus is constituted by two principal centres, and by nerve fibres, the greater portion of which unite the new centres with each other. The centres are the cerebro-spinal axis on the one hand, and, on the other, the mass of the nerve cells distributed to the periphery of the vascular system. The fibres of reunion are of two sorts. They are either vaso-constrictor, or vaso-dilator fibres, in part centripetal, in part centrifugal. The two varieties of vaso-motor fibres are often united in the same nerve trunk. The vaso-dilator filaments are usually, however, more active or in greater number. They relax the vascular parietes, diminishing the activity of the tonic centres. The vaso-constrictor and vaso-dilator fibres, which take their departure from the periphery, pass directly to the tonic centres, and these in their turn emit exclusively constricting fibres, which are diffused over the parietes of the vessels.—*Lo Sperimentale*, April, 1876.

dark colored, and contained albumen and a large number of red globules. The patient stated that he had always lived under good hygienic conditions, and complained only of a slight degree of prostration. Two days passed without any change, out on the morning of the 27th his articulation became embarrassed, and soon after paralysis of the right side of the face and the right arm set in. In the evening he vomited a good deal, and after some hours of quiet sleep he fell into a state of colapse, which lasted until his death, at six A.M. on the 28th of March.

At the autopsy, a clot the size of a walnut was found in the anterior lobe of the left hemisphere of the brain. Microscopical examination revealed a pretty marked fatty degeneration of the arterial tunics of the vessels of the part, and a similar alteration of the capillaries in different parts of the encephalon. The serous membranes, especially the peritoneum, were sown with ecchymotic spots, some as large as the palm of the hand. The heart, muscles, and subcutaneous cellular tissue presented likewise numerous ecchymoses. The mucous membrane of the stomach was swollen and infiltrated with blood, and its epithelium was cloudy. The liver presented yellow spots here

a.



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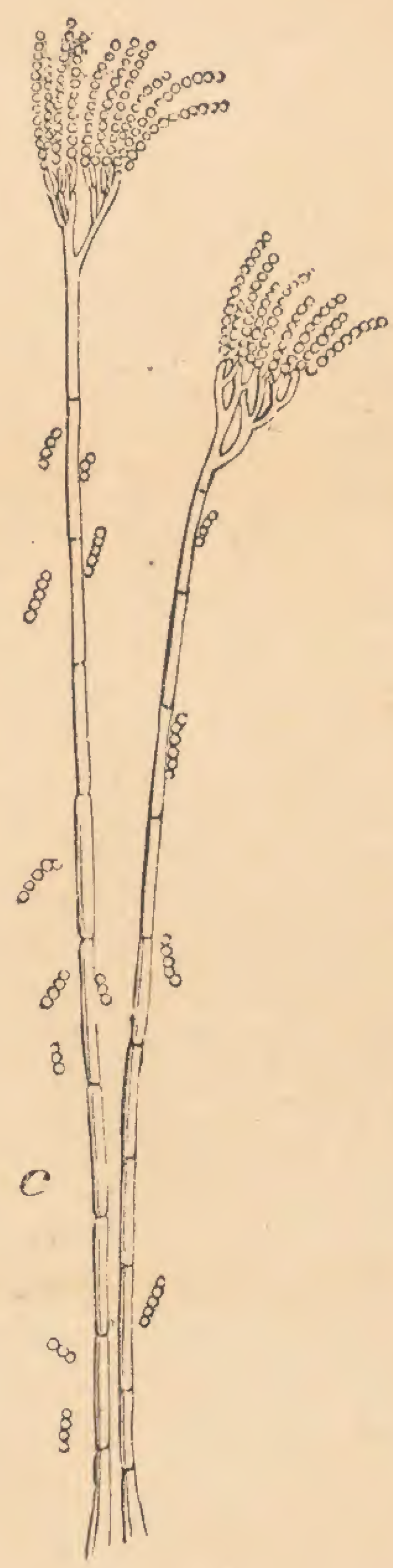
b



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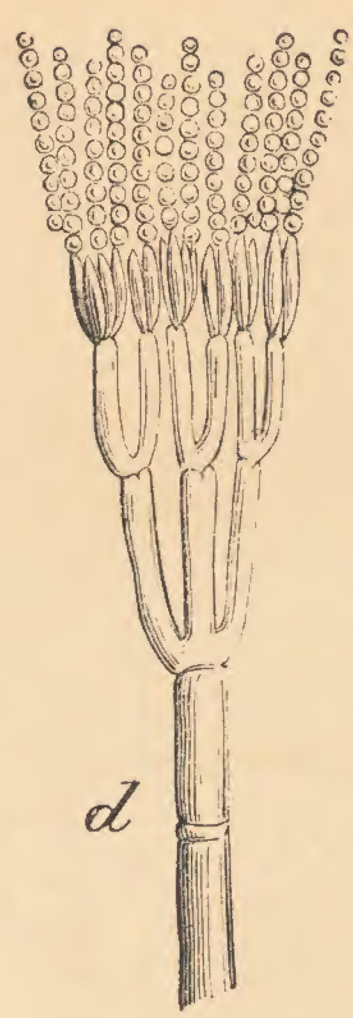
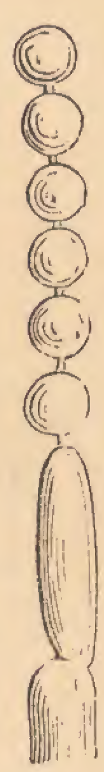


d



e

Penicillium

and poisonous mushrooms. About 500 highly-executed colored drawings have been prepared for the International Exhibition, under the supervision of some of the most noted cryptogamists of Europe and Amerca, from which collection specimens will be selected for publication.

We make our first selection, blue-mold, (*Penicillium glacum*, Grev.,) from a class of common molds which are frequently found on moldy bread and other articles of food, and appear of a greenish or blue color. This genus is supposed to have intimate relations to fermentation; *a*, represents the appearance of the fungus to the naked eye, on a piece of bread; *b*, tuft enlarged; *c*, threads enlarged 420 diameters; *d*, apex x 620; *e*, chain of spores further magnified; *f*, spores germinating.

The drawing is after an original, by M. C. Cooke.

TRAINING OF HORSES.—The following letter was received from a regular and valued correspondent of this Department. It inculcates valuable lessons in the rearing and training of young horses, the proper mode of feeding, and systematic gentleness in handling and teaching. The value of the horse depends so much upon his early training that I give place to this letter because of the valuable lessons it teaches:—[*Commissioner of Agriculture.*

HACIENDA SALUDA,
Greenville County, S. C., December 24, 1875.

SIR: On the 11th December last I purchased two more colts born 4th and 7th May, 1874—both from the same horse—their mothers sound brood-mares of this county. The colts were weaned at seven months old, wintered on corn-fodder and clover-hay, with two quarts per day of corn-meal, moistened with warm water and a little salt. They ran out all winter in a 20-acre hilly lot of ground, with steep gravelly paths to water. At night they nestled together on a warm littered-stable wooden floor, coats

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THE VOICE.

CHAPTER IX.

DEVELOPMENT.

1

P.

General Physiology;

Materials of the Body.

1872.

Beginning of a new Course —

Conflict or blending of feeling —

Elation of enthusiasm of teacher at opening of course of instr. with a class in whose zeal & intellig. he has confidence — sadly tempered by remembrance of the associat. of this place & time.

A year ago — & for many years before, the students of this college were & have been instructed in Phys. & Hygy by a very remarkable person; in intellect & character

It does not fall to me to ^attempt to^ commemorate — others, fully ^competent^ to do this.

A vacancy, — not now, at least, to be filled. I cannot place before myself, or before you, such an expectation. I ~~may~~ ~~intelli~~ endeavor, to the best of my ability, to aid ^you^ ~~have~~ ^in^ laying the foundations of your study of Physiol. & Hygiene. Arduous, and I am anxious & ask & hope for your indulgence in this as ~~my first course~~ ~~just of this kind anywhere.~~ (students)

~~My purpose is to teach all that I can; not to~~ → Address myself chiefly to the supp. prep. of 1st course

~~approach our subject, then, I ask~~

what is ~~Physiol~~ Physiology? (deriv. mean.)

Biology — (Anthropology —)

Now, what is the relation between Physiology & Medicine? Use of Physiology? —

Uses of the study of Physiology:
1st, – in directly preparing for practice.
What can one say of this?
Pathology is altered Physiology
2 views – almost Schools of medicine

Rationalistic – & Empirical
Bennett – & Brown-Séquard – H.C.W. | Trousseau – Todd & Niemeyer –
"we Physiologists are not yet in a position to advise the doctor!; & they, with their more reliable experience are willing
Burdon Sanderson
Met – – hereafter to do without us." Builders of bee's cell from several sides. –

2nd, – for training the scientific mind.
Statical – Anatomy;

A MANUAL

Dynamical, – Physiology.

Both needed – – – OF the scientific spirit required to make empiricism inductive & rational.

3rd, PHYSIOLOGY.

to make experience scientific; to transmute it into Science; the converse being to make Science available in practice. Quackery – otherwise.
Post hoc propter hoc. –

4th – As a basis, the principal basis for hygiene. Here, positive & directly practical in its results.

5th – To correct, oppose & prevent medical errors & superstitions –
Progress of Medicine as a Science has consisted largely in this; & the contest must be maintained.

1882

~~Hygiene~~, –

Modes of Investigation,

and of 2. teaching

Physiology.

~~Investigation.~~

1. By observa.

2. By Comp. anat. & funct. physiol.

3. By effects of disease & injury

4. By experiment:

a. without vivisection

Pettenkofer – feeding box, live-cages –

b. by vivisection.

Viv. secondary – but with limited use for ~~investigation~~

Teaching: exper. no! erudite? –

or elementary? Best the Casts

* There are really 3 states of organic matter; 1. Organizable – as albumen of blood; 2. Organized, – as active muscular tissue or nerve-cells; 3. Post-organic or effete, – as creatin, urea, &c, in the blood or secretions.

PHYSIOLOGY.

much used,

DEFINITIONS.

PHYSIOLOGY is the science of the functions of living beings; including, in its widest acceptation, the study of all the changes which they undergo. There may be, therefore, *vegetable* and *animal* physiology; also, *human* and *comparative* physiology. *Biology* is a word now ~~getting into use,~~ meaning the whole science of life. *Pathology* is the physiology of the body and its organs in a state or states of disease; it is fundamental to the scientific practice of medicine.

PART I.

GENERAL PHYSIOLOGY.

This considers the *materials*, *forces*, and *forms* of organized bodies.

Forces first
1872

CHAPTER I.

ORGANIC MATTER.

THE *matter* of which plants and animals are, or have been, composed, is called, from its being or having been present in their *organs* or instrumental parts, *organic matter*. All other substances, with properties not affected by the presence of life, are inorganic. A distinction is perceptible and important between *organizable* matter and that which *has been* organized, but is no more capable of active function or new formation; for the last, the term *post-organic* would be convenient, although it is not usual.

Between the organic and inorganic materials, differences exist—

1st, in complexity of composition; 2d, in instability; 3dly, in the forms which they tend to assume, especially under the influence of life. Of the whole number of elements in nature supposed by chemists to be simple or undecomposable, scarcely twenty are found taking part in the composition of plants or animals. In mineral and other inorganic bodies, binary compounds are not rare, and ternary ones common; while, in organic substances, four, five, or a still larger number of elements are more often combined; with, also, a large number of *equivalents* of each. From this complexity of composition results great *instability;* shown by the rapid decay or putrefaction to which vegetable and animal structures are liable after their death. This complexity is greatest in *animal* bodies; most of all in the highest animals. Protoplasm not identical.

Carbon, hydrogen, oxygen, and nitrogen are the most nearly universal elements in organic matter. With them occur sulphur, phosphorus, calcium, iron, potassium, sodium, chlorine, silicon, fluorine, and some others, in variable quantities. Animal tissues, except fat (and some very few other partial exceptions among the lowest animals), always have carbon, hydrogen, oxygen, and nitrogen; vegetable substances may consist of the first three of these, without nitrogen; although the latter is also frequently present in plants.

Remembering that *water* is the most abundant of all substances in organized structures, as, for instance, in our own bodies, where it acts as a constituent of both solids and fluids, and as a vehicle of circulation and transmission, we may enumerate the most important other *organizable* proximate (or compound radical) elements, as follows:—

Nitrogenous:

Albumen,	Myosin ~~Musculin~~, Syntonin,
~~Gelatin~~, Chondrin	Globulin,
Ostein,	Casein,
Neurin,	Pulmonin,
Fibrin,	Mucosin.

Also, *pigmentary* or coloring principles, as

or Cruorin ~~Hæmatin~~, of the blood,	Melanin, of the skin, iris, hair, &c.

Non-nitrogenous—oleaginous or fatty:

Olein,	Stearin,
Margarin, — Palmitin	Cerebrin.[1]

Saline substances in the blood furnish some materials for the organization of certain tissues, besides being essential, apparently, to the vital properties of the blood itself. Chlorides of potassium

[1] Liebreich asserts, instead of cerebrin and cerebric acid, the existence in the brain-substance of *protagon;* for which he gives the formula, C_{232}, H_{240}, N_4, P, O_{44}.

Lecithin

Organic Chemistry, — "the chemistry of the Compounds of Carbon",
Natural & artificial chemical history of them, then.

Properties of C, & H. — & O. & N. — Quantivalence $H^{I}O^{II}N^{III}C^{IV}$, &c
Uses of P — (in plants? phosphates) & in bone & brain ———. Silicon —

Calcium — iron — chlorine —
- isomerism - Substitution - comp. radicals —

H_2O CO_2 NH_3
Protoplasm - Bioplasm —
Ascending & Descending series,

Life & Death

Sunset Clouds - analogy
"forms of water."

*Chondrin is precip. from sol. by alum &
acetate of lead — Gelatin not —

and sodium, and carbonates, phosphates, and sulphates of potassa, soda and ~~lime~~, seem to be the most abundant and important of the salts of the blood. Necessary for certain operations, going through.

Organic Products.

Unorganizable (post-organic) compound substances found in the blood and in various secretions and excretions, in process of removal from the body, are, chiefly, as follows :—

Nitrogenous :

Ptyalin,	Taurin,
Pepsin,	Taurocholic acid,
Pancreatin,	Glycocholic acid,
Creatin,	Urea,
Creatinin,	Uric acid.

Also, the pigmentary matters of the bile (biliverdin, cholepyrrhin) and urine (urosacin, uroxanthin.) uro-haematin

Non-nitrogenous :

Lactin,	Cholesterin,
Lactic acid,	Excretin,
Glycogen,	Stercorin.

Besides a number of *saline* substances (urates, sulphates, phosphates, &c.), found in the urine, bile, perspiration, tears, &c.

The full history of these belongs to organic chemistry. A few words may find place here concerning the *organizable* proximate elements.

Organizable Principles.

Albumen is found in blood and lymph, and, though not quite identically one substance, in the white of eggs. Its main peculiarity is its coagulation by heat (160° Fahrenheit); it is coagulated also by strong alcohol, tannin, mineral acids, ferrocyanide of potassium in an acid solution, and salts of lead, mercury, and copper. Antidote — Ulcer of cornea — toothache

Gelatin is present in all the hard and elastic tissues of the body; as cartilages, ligaments, tendons, membranes, &c. It appears, however, that the gelatinous constituents of these tissues undergo some alteration in the common process of extraction by long boiling. The fact that pure gelatin, so obtained, is not capable of sustaining life, when used alone as food, is thus explained.

Ostein is the animal matter of bone. It differs in some chemi- ~~all~~ reactions from cartilage-gelatin (chondrin). Nails and hairs contain *keratin.*

Neurin is a complex substance, presenting two varieties ; gray or ash-colored nerve-substance, found in the cellular or vesicular structure of ganglia, and white neurin, of the tubular filaments, of nerves and commissures.

Tannic acid tans it — in leather —

Fibrin is the spontaneously coagulable ingredient of the blood. The name is given to it because of its forming, in its coagulation, a fibrillary solidification, imitating a low form of tissue.

Musculin, myosin, or syntonin, was long supposed to be identical with fibrin. It is the special constituent of muscular tissue.

Globulin is the substance of the blood-corpuscles.

Casein abounds most in milk, of which it makes about forty parts in a thousand. It is coagulated by feeble acids; as by lactic acid, in the souring of milk. It is highly nutritious. Condensed, it becomes cheese.

Pulmonin is the name sometimes applied to the peculiar substance of lung tissue. Verdeil discovered in this tissue an acid substance, *pneumic acid*, to which importance has been ascribed in the detachment of carbonic acid from the blood in respiration.

Mucosin, of mucus, secreted by mucous membranes, is probably the substance of the membrane slightly altered.

The *pigments* of the blood, skin, iris, and hair contain carbon, hydrogen, oxygen, and nitrogen; sometimes other elements. *Hæmatin*, of the red blood-corpuscle, is notable for the amount of its iron (7 per cent.). *Melanin* is a convenient name for the dark coloring matter of solid parts.

Non-nitrogenous tissue-forming substances are the fats; *olein, margarin, stearin*, and *cerebrin*. The first three are similar in composition. Each consists of a *fatty acid*, oleic, margaric, stearic acid, combined with a base (oxide of glyceryl). Stearin is solid up to 130° or 140° Fahr.; margarin melts at about 120°; olein is liquid down to 25°. Human fat consists of margarin and olein, with very little stearin; deposited in cells. Cerebrin is a more complex substance, found in the brain, associated with phosphorus. Some chemists name, as contained in brain-substance, a nitrogenous acid called cerebric acid, and glycero-phosphoric acid, syntonin, olein, cholesterin, &c.

Increasing complexity from lowest to highest animals

CHAPTER II.

ORGANIC FORCES.

Reason exists for designating by a special name that agency in organized bodies, *i. e.*, plants and animals, which gives them the characters of living beings; and the best name for it is *vital force*, or life-force. *Nerve-force* may, similarly, designate that which is peculiarly the attribute of ganglia and nerves; generated, accumu-

+ fibrin sol. in nitr. pot. ; Syntonin not ;
fibrin very probably not in living blood.

(Protoplasm, presumably ; in connection
with Organic forms.)

protagon — lecithin in brain —

(2)

P.

Forces,

& Blood,

Chyle,

Lymph,

&

Cells.

History of the inquiry concerning "Life."

Savage idea — everything that moves is alive.

~~Nest, Boerhaave ac, all functions~~

Archaeus — anima — unconscious soul

Morell, Laycock, Murphy, ~~Hartmann~~

"Vis medicatrix" —

"animal spirits" in brain —

"Vital principle" —

All functions supposed vital —

Vital force — Beale, Bernard & Coste accept it (Robin, &c, not)

Growth-Force - Type-formation

Evolutionary force of some — constructing, designing — adapting;

but Spencer's ~~definition~~ Too much.

My definition "the continuous adjustment of internal relations to external relations,"

the world an adapted evolution in identity — ~~individuality~~

Nothing as well — "fearfully & wonderfully"

— only farther off & we don't see all the adaptations

Carpenter — Dr waters of St. Louis — &c

Huxley's "Phys. Basis!" (my paper) — = Beale

Cell - repetition — ~~Reach~~ — always — a priori — Rea

(Diversity also, of type) & Energy

Tubercle — proliferation — cancer

quantity for quality

Wurtz is said to have identified a neurine with trimethyl-oxethyl--ammonium!

L. E. & D. Phil Magaz. Nov. 1868 p. 389.

3 ft 5 in. high.
4 ft — wide.
not quite 17 in high.

Cornel Westrake.

together

Light and Electricity. — Adjust a prism so as to get a well-defined solar spectrum; bring the violet rays to bear upon the eye of a steel needle & it will be made magnetic. mechan. effects of light also.

hich the basic aceta
is decomposed by carbonic acid. The Dutch method, which is the, one most extensively used

Fulm. mercury & wet gun cotton.

communication of flame
surrounding atmosphere. Hither
nerally been assumed that the occurrence
olliery explosion, after firing a shot, is due to
actual communication of flame from the gunpowder to the fire-damp; but Mr. Galloway's experiments show that it is much more likely that the explosion is brought about by the noise of the shot being propagated through the galleries of the mine to the safety lamp. An admirable experiment to illustrate this point was exhibited at a recent lecture in the Royal Institution. A lighted Davy lamp was surrounded by streams of coal-gas issuing from a number of jets around the base of the lamp. One extremity of a long tin tube, open at both ends, was placed in connection with the lamp, while a pistol was fired at the other end, a caoutchouc diaphragm being interposed in the tube to prevent the transmission of a direct current of air. The sound-wave, generated by the report, travelled along the tube, and, as soon as it reached the flame, caused ignition of the surrounding atmosphere, the lamp being immediately enveloped in flames.

, consists in exposing ...s of vinegar, atmospheric air, ...cid. In Europe, the lead is cast in the ... thin sheets, which are placed in earthen ... having each a little vinegar in the bottom. ... this country cast lead gratings are substituted for the coils; these rest on ledges near the bottom of the pot. Many hundreds of these pots are packed together in a pile of decomposing tan or stable manure. Over these boards are placed, and then another tier of tan and pots, and so on until the pile sometimes contains many thousands of pots. The warmth given out by the fermentation of the packing volatilizes the acetic acid; the surface of the lead is attacked, a basic acetate is formed, and this is decomposed by the carbonic acid evolved from the tan, forming carbonate and neutral acetate. The neutral acetate in its turn attacks the lead, taking up another atom, becoming basic again only to be decomposed by the carbonic acid. The process

Conversion of force

GRAFTING THE SKIN OF A WHITE MAN UPON A NEGRO.

BY G. TROUP MAXWELL, M.D.,

New Castle, Delaware.

I WAS called in February, 1872, to see James Pearce, a negro, who had been shot in the face by the accidental discharge of a gun. The gun was loaded with bird-shot, and, as Pearce was only a few feet from its muzzle, the charge passed through the left cheek almost in as compact a mass as a solid ball, entering just at the outer border of the orbicularis muscle. The shot made a wide and deep furrow through the soft parts, completely severed the masseter muscle in its middle, and escaped at the posterior border of the ramus of the inferior maxillary bone, just below the lobule of the ear. The buccal mucous membrane and the bone were uninjured; but the wound involved all the structures lying exteriorly to them, and, as by retraction of the severed tissues the lateral dimension of the wound was considerably increased, it presented a horrible appearance, the ghastliness of which was increased by the charred and blackened effect of the burning powder.

An effort was made to contract the limits of the wound as much as possible, by approximating its sides as closely as could be done with adhesive strips and bandages; but, notwithstanding all the care that was taken, the sloughing was so extensive that there resulted a deep, disfiguring wound, of irregular shape, and covering nearly the whole left cheek.

To expedite the healing process, and to prevent, as far as possible, the disfigurement of an extensive cicatrix, I proposed to graft skin into the wound as soon as it presented a healthy granulating surface. This proposition having been assented to, I performed that operation in March, about four weeks after the injury was received.

Whilst making preparations for the operation, the idea of grafting the skin of a white man upon a negro occurred to me; and, having obtained the consent of my patient to the procedure, I clipped from my own left forearm a piece of skin about the size of a dime, for the purpose. I also took a piece from his forearm, intending to graft both white and black skin.

These pieces of skin were divided into small fragments about the size of canary-seeds, and four of each kind were carefully inserted into the surface of the wound.

On the tenth day, the bandages and strips of plaster which held the grafts *in situ* were removed, and six of the eight grafts were discovered to possess vitality and to encourage the hope of success.

Unfortunately, that day, after the dressings had been changed, my patient got on a "spree," and, whilst intoxicated, destroyed four of the grafts. Happily for the success of my experiment, of the remaining two, one was white. These grafts grew finely, extending themselves in all directions, and assisted materially in closing the wound, which was quickly done.

Besides the wish to heal the wound as speedily as possible and with the slightest amount of cicatricial contraction, considerable interest was felt in the result of the experiment—which, so far as I am informed, had never been done before—of grafting the skin of a white person upon a negro. It was a source of gratification, therefore, to witness the growth of the white graft, and I watched its progress with peculiar pleasure. From the size of a canary-seed, it increased to the extent of about a half-inch in its greatest dimensions, and was of irregular form, with narrow points extending into the surrounding black surface.

Meeting Pearce on the road after the wound had healed, I readily distinguished the white patch in the side of his face, twenty to thirty yards distant. Upon examination at that time, dark-colored lines, forming a net-work in the white skin and giving it a purplish tinge, were discerned. These, I supposed, were blood-vessels. These vessels increased in size and number, producing a corresponding deepening of the color of the patch, until by the end of the third month the whole surface of the wound was of a uniform blackness. The white skin had lost its distinguishing characteristics.

Does not ~~this~~ experiment prove that the coloring-matter of the ~~skin,~~ its pigment, which varies in quantity in individuals ~~as~~ well as in races, is due to cells which are developed ~~in the~~ liquor sanguinis, and not to any peculiarity in the cells of the skin itself? The reverse.

See Bryant's Surgery chapter on Skin-Grafting for the Converse of the within case.

gastric region. As I was not at home, another physician prescribed. About six hours later I found her in intense agony, abdomen tympanitic and painful to the touch, hurried respiration, and rapid wiry pulse. Death followed in about twenty hours.

Autopsy made one day after death, by Dr. Haynes and myself, revealed the following:

Peritoneum injected, showing everywhere traces of inflammatory change. Pus and liquid fæces low in peritoneal sac. The empty sac of a large abscess was found upon the upper left side of the uterus, the summit and side of which were partially attached to the colon of the corresponding side.

Treatment after the rupture of the abscess was, of course, unavailing. But had the abscess been discovered a few days earlier and a bistoury passed through the uterine wall into it, allowing the pus to escape via the uterine cavity and vagina, there is no doubt that she *might* have been saved.

2228 North Front Street, Phila.

NOTES OF HOSPITAL PRACTICE.

UNIVERSITY OF PENNSYLVANIA.

SERVICE OF DR. LOUIS A. DUHRING.

Reported by Dr. Arthur Van Harlingen.

DERMATO-SYPHILIS.

THIS man presents an eruption consisting of some half-dozen ulcers, grouped so as to form a semicircular patch about three inches in diameter, on the arm, midway between the elbow and the axilla.

The appearance of these ulcers is characteristic of the disease: they are crescentic, vary in size from that of a pea to that of a large bean, have a deep, punched-out appearance, and are covered with a sanious, yellowish-gray exudation.

The patient states that he has never had chancre or other symptom of syphilis. He had an attack of gonorrhœa many years back.

About one year ago he noticed a small nodule or tubercle on his arm at the seat of the present eruption, followed shortly after by several others of the same nature, which eventually broke down and formed the ulcers for which he now seeks relief. These ulcers increased in size with remarkable slowness.

In spite of the total absence of any history of a primary lesion or of any of the earlier symptoms of syphilis, there can be no doubt that the sores are due to syphilis and nothing else. We need nothing more than these appearances to make our diagnosis. Should we in these cases rely on always obtaining a history of syphilis, we should often be very much at fault with our diagnosis.

... which the disease has

characteristic of hereditary infantile syphilis. The skin is sallow and wrinkled, the eyes are hollow, and the skin of the face has a dead, waxy look, with a drawn expression about the mouth. The whole aspect of the child, in fact, resembles that of premature old age and decrepitude.

In addition to these signs of general malnutrition, we have more positive evidences of disease. A scattered papular eruption exists over the body and limbs; there are also pustules about the soles of the feet, desquamation of the skin on the palms of the hands, and one or two small abscesses on the fingers. About the genitals there are, you will observe, a number of well-marked mucous patches. Considerable stuffing up of the nasal passages exists, but as yet there is no discharge. A thin, yellowish fluid oozes from one ear.

A case like this demands prompt and energetic treatment and yet great caution; for a very slight matter will often be sufficient to upset the balance of so precarious an existence, and cause the physician to be unjustly blamed.

The treatment adopted in this case has been as follows. At first baths containing corrosive sublimate were directed. Ten grains of the sublimate were to be dissolved in a wash-tub of water sufficiently warm, so that the little patient might not get a chill in the bath. In this bath the infant was to be immersed for ten or fifteen minutes, care being taken that none of the solution should be splashed into its mouth or eyes.

In many cases this treatment is sufficient. It was continued for about a week in this instance, and then, as the mother became apprehensive lest the child should die in one of the baths, they were discontinued, and another plan was adopted. Inunctions were directed of the following:

℞ Unguent. hydrarg.,
Adipis, āā ℥ss. M.

Of this ointment a piece the size of a pea was to be rubbed well into the skin of the abdomen and other parts of the body alternately, care being taken not to rub too frequently in any one locality, and to avoid abrasions.

Under the use of these inunctions decided improvement has taken place: the child sleeps well, his appetite is better, and his general appearance is much improved. The prognosis, however, can scarcely be called favorable,—the appearance of several large abscesses on different parts of the body showing such a tendency to disintegration of tissues as renders the prospect of recovery slight.

1876

TYNDALL ON SPONTANEOUS GENERATION.

From the New York World of this morning.

Professor Tyndall has recently brought before the Royal Society the results of a new and ingenious series of experiments bearing upon the vexed question of spontaneous generation—a question which, despite the researches of Pasteur and Schroeder and their numerous followers, on the one hand, and the arguments of Bastian and the dogmatism of Haeckel on the other, is still far from a satisfactory settlement. The great difficulty in the discussion of the problem has lain in the unaccountable contradiction of the disputants on either side, who claim to have obtained diametrically opposite conclusions under apparently identical conditions; each party in turn repeating every fresh experiment devised by the other, and finding therein confirmation of its own views. A striking instance of this discrepancy of observation is given in Tyndall's paper. Not long ago Dr. Bastian announced that if an infusion of animal tissue be boiled in a glass vessel, the mouth of which is hermetically sealed during ebullition, and kept in a warm place, "after a variable time the previously heated fluid within the hermetically sealed flasks swarms more or less plentifully with bacteria and allied organisms. "Acting on this statement, Professor Tyndall prepared in the manner specified 139 flasks containing various infusions of fish, flesh and fowl, and out of all these not one showed any evidence of implanted life, So,

tence and mag... ject herself to more urging, she ... England without another interview.

The long-desired chance was to grow directly out of the feud between Forrest a... Macready. When Maddox, Forrest's ma... ger, approached her she said:—"I w... accede on certain conditions. In the fi... place, ten pounds a night; in the second, ... must have one night, before Forrest com... for my debut in a great part. I will pl... 'Bianca.'" Maddox struggled and pleade... but was finally compelled to yield.

That Thursday night big with her fate a... rived, and the curtain went up on a cold a... meagre audience. The first two acts pass... tamely enough, for the company supporti... her seemed utterly indifferent to their wo... But in the third act the audience commenc... to look at each other and wonder, and th... hearts to burn. The passionate intensity ... the "Bianca" electrified, too, the inert sto... with which she was surrounded, and t... were involuntarily swept, by the magn... power that seemed to radiate from her, ... something like *rapport* in their own act... But in the fourth act Miss Cushman car... everything before her. The mighty pas... and agony of the last great scene wa... overpowering that the actress fainted a... at its close, and she had to be supporte... front of the curtain to acknowledge the... tinued and tumultuous thunders of appl... with which that English audience welc... the rise of another great light on their ... matic horizon.

She slept that night with an infinite ... in her heart. The triumph that she ... looked forward to and labored over fo... long years of anguish, suffering, toil, ... want of appreciation had at last come, ... in such full measure as to gratify her ut... wishes.

APH.

EET—THREE CENTS.

too, with infusions exposed to air filtered through cotton wool, or to calcined air, or preserved *in vacuo*, in all of which living organisms were found by Bastian, in none by Tyndall. To account for such differences it has been easy for one set of disputants to allege that where organisms are found, their infinitesimally minute germs must have been admitted through carelessness in manipulation, whilst the opposing faction have insisted that in the negative experiments the air or the infusion was not merely secluded from the entrance of foreign germs, but in some way deprived of its capacity to support life.

To eliminate these sources of uncertainty Professor Tyndall has operated with air absolutely "untortured" by any artificial process, and containing the usual amount of aqueous vapor and other gaseous matters, purified only by the natural settling of the suspended organic particles. His apparatus consisted of a box with a glass front and panes of glass facing each other at the sides, so that it could be perceived when the inclosed air no longer showed floating motes in a transmitted beam of bright light. The interior of the box was smeared with glycerine to entrap the settling particles and from the top two bent tubes were open to the outer atmosphere. At the bottom were placed test tubes to contain the fluids under observation, so arranged that they could be filled by means of a long glass tube from the top. The purpose of this apparatus, it will be perceived, was simply to shield the contained air from disturbance without in any way altering its constitution. At first, a concentrated beam of light, passed through the box, had its track made visible by floating matter, but after three days of quiet the interior air was moteless to the transmitted ray. The test-tubes were then filled with various infusions of vegetable and animal substances, boiled for five minutes, and abandoned to their fate. The result of numerous experiments was that whilst similar infusions in the outer atmosphere invariably putrefied and swarmed with organisms in from two to four days, not one of those kept in the moteless air of the box showed any sign of putrefaction or bacterial life; yet, after thus remaining unaltered for four months, the opening of a little trap-door to admit freely the external mote-laden air caused an abundant production of bacteria in three days. These investigations seem fully to justify the author's inference that even the lowest forms of vegetable life can only arise from implanted ultra-microscopic germs, and at all events throw a new burden of proof upon the upholders of abiogenesis.

A further series of experiments to test the atmospheric diffusion of germs led to some exceedingly suggestive deductions with regard to the spread of epidemic contagia. A tray holding 100 test-tubes, thirty of which contained an infusion of clay, thirty-five an infusion of turnips, and thirty-five an infusion of beef, being freely exposed to the atmosphere, it was noted that the different tubes were attacked by putrefaction at different times and in different degrees. One tube of the beef group was first invaded, and became turbid a day in advance of any of the rest; a single one of the hay group showed muddiness, while its immediate neighbors remained clear; four of the turnip group, separated from each other by considerable intervals, were involved several hours before their fellows; and so on successively until all the tubes were affected. Even then, of tubes containing the same infusion, in some bacteria preponderated and showed great activity, whilst in others they moved feebly and were overpowered by a fungus known as *penicillium*. From these and other phenomena Professor Tyndall concludes that the bacterial germs float through the atmosphere in small clouds with sparsely-occupied spaces between them, and he further opines that the germs differ among themselves in respect of fitness for development, some being fresh, others old, in different conditions of dryness or moisture; and in this way he accounts for the successive outbreaks of epidemic disease, and the varying periods of latency and greater or less degree of severity of the malady in different individuals.

1876

CREMATION IN ITALY.

An Ancient Custom Revived—A Templ of Cremation in Milan—Alberto Kel ler's Legacy—An Interesting Cere mony—Ashes to Ashes—Progress o the Theory.

MILAN, Jan. 25.—The latest sensation here is a genuine case of cremation, which occurred at one of the principal cemeteries i Milan last week. It appears that a wealthy German gentleman named Alberto Keller, who resided here for many years previous t his death, was a strict believer in the theory of cremation, and in his will provided that a temple of cremation should be built in th Cemeterio Monumentale (where he had previously erected a handsome family tomb) and presented to the city of Milan, and that when it should be ready for use his remains were to be cremated therein, and his ashe deposited in the family tomb.

About two years ago Mr. Keller bade adieu to things terrestrial, and his body was em balmed and consigned to the vault under neath the tomb. Shortly afterwards experi ments were commenced by Messrs. Clericett and Polli, a system was invented which wa perfected, and a temple of cremation wa built in the cemetery.

The building is a miniature model of th ancient Roman temples, and stands on piece of ground about fifty feet square. Fif teen solid stone pillars, about eighteen fee in height and two in thickness, placed in circle, support a dome-shaped roof, whic is in turn surmounted by the figure of a urn. In the centre, reached by four o five steps, is a large stone sarcophagus, some seven or eight feet long and about three in width. On each side are three round black marble slabs, on the centre one o which is a white cross. The slab at one end acts as a door, being moved up and down by invisible machinery. In the interior of the sarcophagus are a large number of iron ribs extending from one side to the other, and uniformly curved downwards slightly in the centre. Underneath this gridiron arrangement is a platform of iron from which projects a forest of gas-burners. Along the side of the receptacle, just above the iron bars are rows of round, knob-like buttons, with hole in the centre; these are also used fo the issue of gas-jets—the total numbe of which in the sarcophagus amounts to 217 The force of gas employed, as well as th machinery which opens and shuts the ponderous door, is controlled from a smal brick building some ten or fifteen feet i the rear of the edifice, the connecting machi nery being under ground. On the front o the temple, under the dome, is a tablet wit an inscription, of which the following is translation:—"Cremation Temple, donate at the desire of the noble Alberto Keller, t the City of Milan."

After the completion of the edifice, the i ventors experimented upon the carcasses dogs and other animals, for the purpose determining how great a degree of heat an what time were necessary to consume human body. Everything being in readines last Saturday, the second anniversary of M Keller's death, was fixed upon to practicall test upon the remains of the founder th purpose for which the temple was erecte On that day, at 2 o'clock, the inventors the system, accompanied by some of the re latives of the deceased, the principal mun cipal officers, and a large number of scientif men and journalists, representing the princi pal cities of Europe, assembled at the Kelle tomb. At 2 o'clock the body was taken fro its casket in the vault and placed in thin wooden case, which was covered with black cloth. The features of the corpse we as natural as on the day on which it was e tombed, two years before. Preceded by th clergyman of the Evangelical church, which Keller had been a member, the bod followed by the assemblage who ha gathered to witness the ceremony, was tak to the temple of cremation, which is situate near the rear wall of the cemetery, in a co spicuous position, and can be seen from an point of the grounds, which are perfectl flat, and unadorned with shrubbery or tree the want of which is made up, however, b some fine specimens of sculpture, surmou ing tombs and graves.

On arriving at the mausoleum, the cler man in attendance made a few remar during which the body was deposited front of the sarcophagus. In his address reverend gentleman said that the ceremo of cremation was not against the accep forms of burial; in that form it offered example of the fleeting existence of matt

Force = that which does work,

Ether? – Grove – Helmholtz – Faraday – Tyndall – Henry

lated, and reflected by ganglia, and transmitted by nerves. Animals only, not plants, possess this.

The ordinary *cosmic* forces (*i. e.*, forces common to all nature), heat, light, electricity, chemical attraction, gravitation, all affect organized beings. They are not unfrequently generated or transformed by vital processes; and have importance in various functions.

The doctrine of the correlation and convertibility of the forces of nature is indispensable, now, in physiology, as it is in physics. By it we mean, that heat, light, electricity, &c., are (not substances, but) different *modes of movement;* and that one kind of motion may be transmuted into another, by a change of conditions. This is true of life-force and nerve-force; these being dependent upon heat, light, &c., for their sustenance, and being sometimes, conversely, transmuted into those forces. Of the last change, the luminosity of the fire-fly is probably an example. Heat lost in hatching eggs 10°

Vital Force.

Life-force ought to be studied, then, like the other forces of nature. By exclusion, we find, that, after most functions of the animal or vegetable organs have been explained by reference to chemical, mechanical, or other ordinary physical laws, something is still left. That is, *formation, growth, development;* the construction, from a formless liquid (blood, sap), of definitely formed structures, going through a series of changes for a definite period. We call the cause of this adaptive formation and change *life.* When it ceases, *death* is characterized by the loss of all that was peculiar to the being, and the return of its materials to the inorganic (through the post-organic) state.

We may enumerate the main facts established concerning vital force, as follows: 1. It is common to *animals* and *plants.* 2. It never originates except from parentage; *omne vivum ex vivo.* 3. Its action is essentially *formative* and *reparative.* 4. In the living body, it *controls* and *directs* the other physical forces, as chemical affinity, etc., modifying their results. 5. It acts *expansively,* from centres outwards; as shown by the production of rounded forms, cells, &c. 6. Sometimes it may be *transmuted* into other forces during life, and is altogether so at death. 7. Other forces, *especially heat, sustain* it, or are converted into it. 8. Sometimes it may be *suspended* for a time; as in the winter torpor of certain animals. 9. It is always *definitely limited* in duration under any particular form; that is, each individual can live only for a certain time, longer or shorter according to its species. 10. Life-force may *vary in degree,* in the same body at different times, and in the different parts of the same organism. This last proposition affords the best foundation for rational pathology. Yet it would be a serious error to suppose that *all* disease consists merely in diminished vitality, general or local.

19

→ Back next to Org. Materials

1872

Frey, Rouget & Kuss consider blood a tissue

~~Begin Review, 71. To foot of p. 232.~~

25 billions of red corpuscles in all!

CHAPTER III.

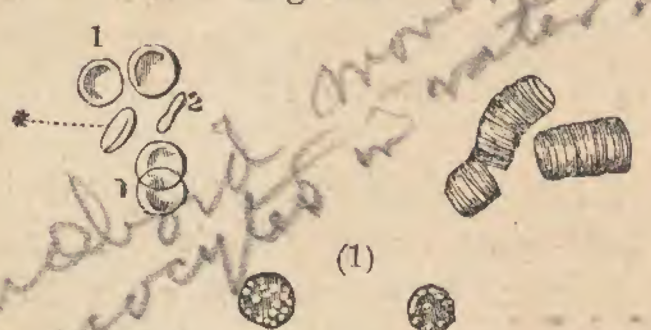
ORGANIC FORMS.

Liquids and solids together make up every organized body which has active functions. The liquids in plants are the sap, and sometimes special juices; in animals, the *blood, lymph, chyle,* and various secretions. The solids are the *organs*, composed of various *tissues;* and these, of elementary forms, viz., *cells, fibres, membranes, tubes.* molecules, nuclei,

of Animals The Blood.

As seen under the microscope, the blood consists of a colorless liquid (liquor sanguinis) in which float the red and the white or colorless corpuscles; from fifty to five hundred of the red, to one of the colorless in human blood. Of the former, the diameter is about $\frac{1}{3300}$th of an inch; of the white corpuscles, $\frac{1}{2500}$th. The latter are nucleated; the red corpuscles in man are not.* The shape of the red corpuscles is disk-like or car-wheel-like; *i. e.*, circular, flattened, and concave at the middle. Carbonic acid and some other gases, when absorbed, swell the corpuscles into a more globular form; oxygen widens and flattens them. The difference in color between arterial (oxygenated) and venous blood is by some ascribed to this change of shape. The biconcave corpuscles concentrate the light which they reflect, giving a brilliant effect; while the diffusion of rays reflected from the more convex surfaces of the corpuscles of venous blood produces a dull purple color. Another view is, that blood-corpuscles contain a special principle, *cruorin*, the color of which is altered by the absorption and loss of oxygen.

Fig. 94.



Blood Corpuscles.

amoeboid movement of leucocytes in water.

Human blood has a salt taste, a peculiar odor, alkaline reaction to test paper, and, while in the living bloodvessels, a temperature of 100°. When drawn from the body, in about ten minutes it begins to *coagulate* or clot; the total separation of the coagulum from the liquid *serum* taking place gradually, and requiring many hours. In the *clot* is the fibrin of the blood, and its corpuscles; in the *serum*, albumen, the salts, and water. A *buffy coat* is sometimes seen on the surface of the clot, when the red corpuscles

* Total red corpuscles (to 4th month) nucleated Kuss
Savory says the appearance of nucleus in red corp. of birds, reptiles, amphibia & fish is postmortem only.
White corpuscles differ much less in size among animals.

THE NUMBER OF THE RED BLOOD-CORPUSCLES IN MAMMALS, BIRDS, AND FISHES.—M. Malassez (*Comptes Rendus*, lxxv. 1528-1531) describes a method by which the red as well as the white blood corpuscles can be readily counted. According to the method recommended by M. Potam, a drop of blood is mixed in exact proportion with some preservative liquid, and introduced into an *artificial capillary*, which consists of a flattened glass tube, in which the volume is calculated for each unit of length. By means of a microscope, the eyepiece of which is divided into squares, the number of corpuscles comprised within a certain number of squares can be counted. Knowing the length of tube corresponding to the squares and the corresponding volume, one can easily calculate the number of corpuscles in the cubic millimètre.

Among the mammals the number varies from 3,500,000 to 18,000,000 in the cubic millimètre. The average number in man is 4,000,000. Camels possess from 10,000,000 to 10,400,000. In the goat the number amounts to 18,000,000. The porpoise has 3,600,000—a number exceeding that found in fishes. Birds have fewer than mammals. The maximum is 4,000,000, the minimum 1,600,000, the mean being about 3,000,000. Fishes have still fewer, and there is a difference between osseous and cartilaginous fishes. Osseous fishes possess 700,000 to 2,000,000. Cartilaginous fishes have 140,000 to 230,000.

Thus the number of corpuscles diminishes as one descends the animal series. But the richness of the blood depends not on the mere number, but also on the surface, volume, and weight of the globule in the cubic millimètre, and also on the amount of hæmoglobin in each corpuscle. The author has not been able to resolve these questions, but compares the number of the corpuscles with their dimensions. The corpuscles increase in size as we descend the animal scale, so that there is an inverse proportion between the size and number of the corpuscles. This proportion is not, however, altogether constant, for man has fewer than the dromedary or llama, and at the same time smaller corpuscles.

The consequence of this inverse proportion is, that the diminution of the number is compensated by the increase in volume. This is not always exact, however, as birds gain more by the augmentation in volume than they lose by the diminution in number, the weight of the bird's being greater than that of the mammalian corpuscle. D. FERRIER, M.D.

More iron in blood of English than in Hindoos.

Transfusion of blood

were also detected. Dr. Lewis calculates, from the relative numbers existing in specimens of the blood which he examined in one case, that at least 140,000 of these creatures must have existed at the same time. In the kidneys and suprarenal capsules of a woman who died of chyluria, Filariæ were found to exist in great abundance. They do not seem to undergo further development in the body, as they were found in the blood after two and a half years, of precisely the same character as before. The form of chyluria with which this condition of the blood is associated, is local, and intimately related to a tropical climate. The milky condition of the urine comes on suddenly, not only at first, but on succeeding occasions also. There are no tube-casts in the urine. It is frequently associated with more or less distinctly marked symptoms of various other obscure diseases—such as partial deafness and diarrhœa, often very persistent; chronic conjunctivitis, or some more deeply seated defect in the visual organs; and sometimes temporary swellings in the face or extremities.

Dr. Lewis seems inclined to believe, from certain intestinal ulcerations discovered *post mortem*, that the parasites gain access to the system by the alimentary canal, possibly from the tank water or the fish inhabiting it.

The condition of the urine, the most characteristic symptom, is probably due to the mechanical interruption offered (by the accidental aggregation, perhaps, of the hæmatozoa) to the flow of the nutritive fluids of the body in various channels, giving rise to the obstruction of the current within them, or to rupture of their extremely delicate walls, and thus causing the contents of the lacteals, lymphatics, or capillaries to escape into the most conveniently placed excretory channel.

These occurrences are liable to return after long intervals—so long, in fact, as the Filariæ continue to dwell in the blood.

[This subject is far too important to be discussed within the limits of the space at our disposal at present. Admirable in all respects as is Dr. Lewis's report considered in reference to the facts observed —and they are recorded with all the accuracy of a true *savant*—he is evidently not well posted in the recent literature of hæmatozoal research in general, nor in respect of the development of human Trematoda in particular. The statements of Leuckart, Vix, Bastian, Heller, Wucherer, and others, will afford Dr. Lewis much of the assistance he requires in view

Red corpuscles of man nearly as large as those of elephant & whales, larger than those of the horse, a little larger only than those of the humming-bird, though of a different shape from the latter. In all oviparous animals they are oval; but so in the camel also.

Smallest of mammals, in musk-deer: less than 1-12000 of an inch. Largest of all examined, in amphibian proteus: $\frac{1}{400}$ of an inch. Large also in the triton — about $\frac{1}{800}$ of an inch.

Size of Red corpuscles

In the labor of the experiments Dr. Keyes was assisted by Dr. A. L. Stimson, and observations relating to the following points were noted:

1. *Average of red blood-corpuscles in* 1 *cubic mm. of blood of the healthy adult male.*—A high average is 5 millions. Anæmia rarely goes below 3 millions, and in five instances the count reached above 6 millions.

2. *Effect of small doses of mercury upon the blood early in syphilis.*—In all the cases counted, the number of the red blood-corpuscles increased under the influence of mercury, good hygiene, and tonics.

3. *Effect of the long-continued use of small doses of mercury upon the blood in syphilis.*—There were three cases: the drug was administered respectively, eleven, six, and eighteen months; the blood-count was above the healthy average, and clinically they were all in excellent health.

4. *Effect of mercury in excess upon the blood in syphilis.*—In this, the only case in which salivation had been present (produced for special reasons), the count showed a loss of one million, which was attributed to the excessive use of mercury.

Mr. F., a very robust man of 65 years, own account, was "never sick in his life," after leaving the bedside of a dying son was taken on the morning of Nov. 19 with vertigo and vomiting. I found him in bed at 9 A.M., feeling better. Nov. 23d, I was again sent for. Found him up, but complaining of severe pain over cardiac region. Prescribed anodynes, and he soon obtained relief. Nov. 25th, he again sent for me. He had suffered all night from the pain in his chest again.* Pulse 100. Murmur over the heart not well defined, seemingly aortic. At 9 A.M. prescribed opiates. At 9 P.M. found him comfortable. Had taken a little food. He expressed to his friends at 10 P.M. that he felt as well as ever. He slept until one o'clock, and then arose to urinate. He spoke cheerfully to his wife; said he felt quite well, and thought he should pass a comfortable night, and then springing into bed quickly dropped over dead.

Post-mortem held Nov. 28th, 9 P.M.

The lesion was one of rupture, apparently due to thinning of the walls from fatty degeneration. On examining the internal surface of the arch of the aorta, there were found small patches of atheroma.

THE BLOOD-CORPUSCLES IN SYPHILIS.

To the Editor of The Medical Record.

Dear Sir:—In the report of my remarks on Dr. Keyes's interesting paper in your issue of January 8th, I am made to say that it is the accumulation of white blood-cells which constitutes one of the manifestations of syphilis.

What I did say was, that the accumulation of *vitiated*—that is to say *imperfect* cells (which could not be distinguished under the microscope from the normal white blood-corpuscles) constituted the material of *every* known manifestation of syphilis. That chancrous indurations, syphilitic gland enlargements, syphilitic papules and tubercles, gummy tumors, etc., were all made up of these *vitiated* white blood-corpuscles; and that the evidence of their vitiation or imperfection was in the fact that such accumulated corpuscles were never able in any instance to enter into the composition of any useful tissue, but were only present as an obstruction to the healthy action of the vessels and tissues with which they were in contact—*and hence* the elimination of this *imperfect* material, was the direct object of treatment; that mercury, which was known to be an active agent in bringing about the fatty degeneration of *healthy* tissues, might be readily accepted as capable of effecting the same result more easily and promptly in the case of the imperfect material; that chemical experience had shown *this* to be the fact, inasmuch as the moderate and prolonged use of mercurials has been found to be more efficacious in the cure of syphilis, and less harmful to the general system of the patient than where it was pushed to salivation, as was formerly considered essential, *and hence* we were led intelligently to the treatment of syphilis by a mild and prolonged mercurial course, rather than to the adoption of the

medical department six colonels and twelve lieutenant colonels.

HOMŒOPATHY IN MICHIGAN UNIVERSITY.

It will be remembered that in a recent number we made this remark:

"In answer to an inquiry by some of the students of the Medical Department of the Michigan University, Prof. Palmer is reported to have said in substance: 'With Dr. Sager it was a question of only two hundred dollars, while with us (the Faculty) it was a question of eighteen hundred dollars.' If there is any real foundation for this assertion it would appear that the matter of principle is not the only one which has actuated the said faculty in the stand which they have taken. We sincerely hope that some reasonable excuse can be offered for lowering the dignity of the position assumed to the meanness of a pecuniary consideration."

In a subsequent number it will be recollected that Prof. Palmer emphatically denied the charge. Since then we have communicated with our informant, and find that he had no foundation whatever for the statement he made to us. We always strive to obtain our information on good authority, but in the present instance we have been in error, and willingly acknowledge the fact. If our readers were acquainted with all the circumstances connected with this information, as we now are, they would not think it strange that we had been misled. However, we were careful enough

According to Preyer & E. R. Lankester,

(~~brown cruorine of Sorby~~) on spectroscopic evidence

hæmatin results from splitting of hæmoglobin

into (methæmoglobin) & an albumen.

(brown cruorin of Sorby)

Cole – Walker – Hausa

dates & particulars?

~~See 2nd edition of my book for~~

~~compar size of red corpuscles.~~

sink with unusual rapidity. In like cases, as of inflammatory disease, the coagulum may present a *cupped* top.

Fig. 95.

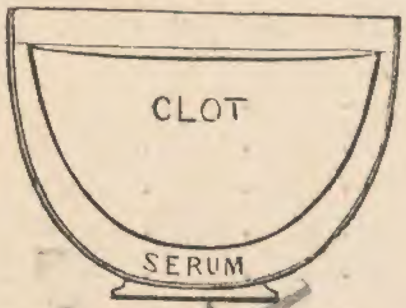
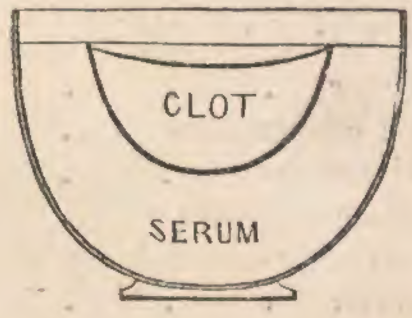


Fig. 96.



BLOOD COAGULA.

The cause of the coagulation of blood out of the body, or even within it if the circulation be arrested (as within the sac of an aneurism) is not known, further than that it depends upon the presence of fibrin. Richardson's theory, that it was owing to the escape of ammonia, whose presence in the blood kept the fibrin liquid, is open to many objections, and has now been abandoned by its proposer. Another ~~The simplest~~ view is, that *vitality* maintains the fluidity of the fibrin of the blood, and that when dead it becomes solid; as heat makes many things liquid, which congeal when they cool. The analogy is legitimate.

Still (in any treatise)

Coagulation is retarded by cold, and favored by rest, free access of air, and the multiplication of points of contact. In the act of death, or shortly before it, clots sometimes form in the heart and

Fig. 97.

Lister ascribes coagula, to influence of contact of foreign matter. This is clearly insufficient. Kühne & Schmidt's opinion is accepted by many, — that fibrin is only produced by union of globulin (fibrinoplastin) of corpuscles & paraglobulin or fibrinogen. of serum

BLOOD-CRYSTALS.

obstruct its valves. When blood has been at rest for a considerable time, *blood-crystals*, of hæmatoidin or hæmato-crystalline often form in it, of various shapes.

Nomen

Another ~~theory~~ (Denis—see Kiss) is ~~that~~ ~~plasmin~~ of living blood separates into soluble & concrete fibrin; the latter makes the coagulation.

The *amount* of blood in a human body is not exactly ascertainable. It may be estimated at from fifteen to twenty pounds. Its *composition* is given by Dr. Kirkes, on the basis of numerous analyses by different observers, as follows:—

Average proportions of principal constituents in 1000 parts:—

Water	784
Red corpuscles	130
Albumen	70
Saline matters	6.03
Extractive and fatty matters	7.77
Fibrin	2.2
	1000.00

It is remarkable that the blood never contains any gelatin. Its potassium is contained chiefly in the corpuscles; chloride of sodium in the liquor sanguinis or plasma.

Average proportions of all the constituents of the blood in 1000 parts:—

Water		784
Albumen		70
Fibrin		2.2
Red corpuscles:—		
globulin		123.5
hæmatin		7.5
Fatty matter:—		
cholesterin	0.08	1.3
cerebrin	0.4	
serolin	0.02	
oleic and margaric acids		
volatile and odorous fatty acids		
fat containing phosphorus		
Inorganic salts:—		
chloride of sodium		3.6
chloride of potassium		0.36
tribasic phosphate of soda		0.2
carbonate of soda		0.84
sulphate of soda		0.28
phosphates of lime and magnesia		0.25
oxide and phosphate of iron		0.5
Extractive matter, with salivary matter, urea, creatin, creatinin, lactic acid, biliary coloring matter, gases, and accidental substances		5.47
		1000.00

The *gases* of the blood are, ordinarily, oxygen, nitrogen, and carbonic acid gas.

The *development* of the blood is an obscure subject. There appear to be two sets of blood corpuscles; the first peculiar to fœtal life, originating as primary cells in the *vascular layer* of the em-

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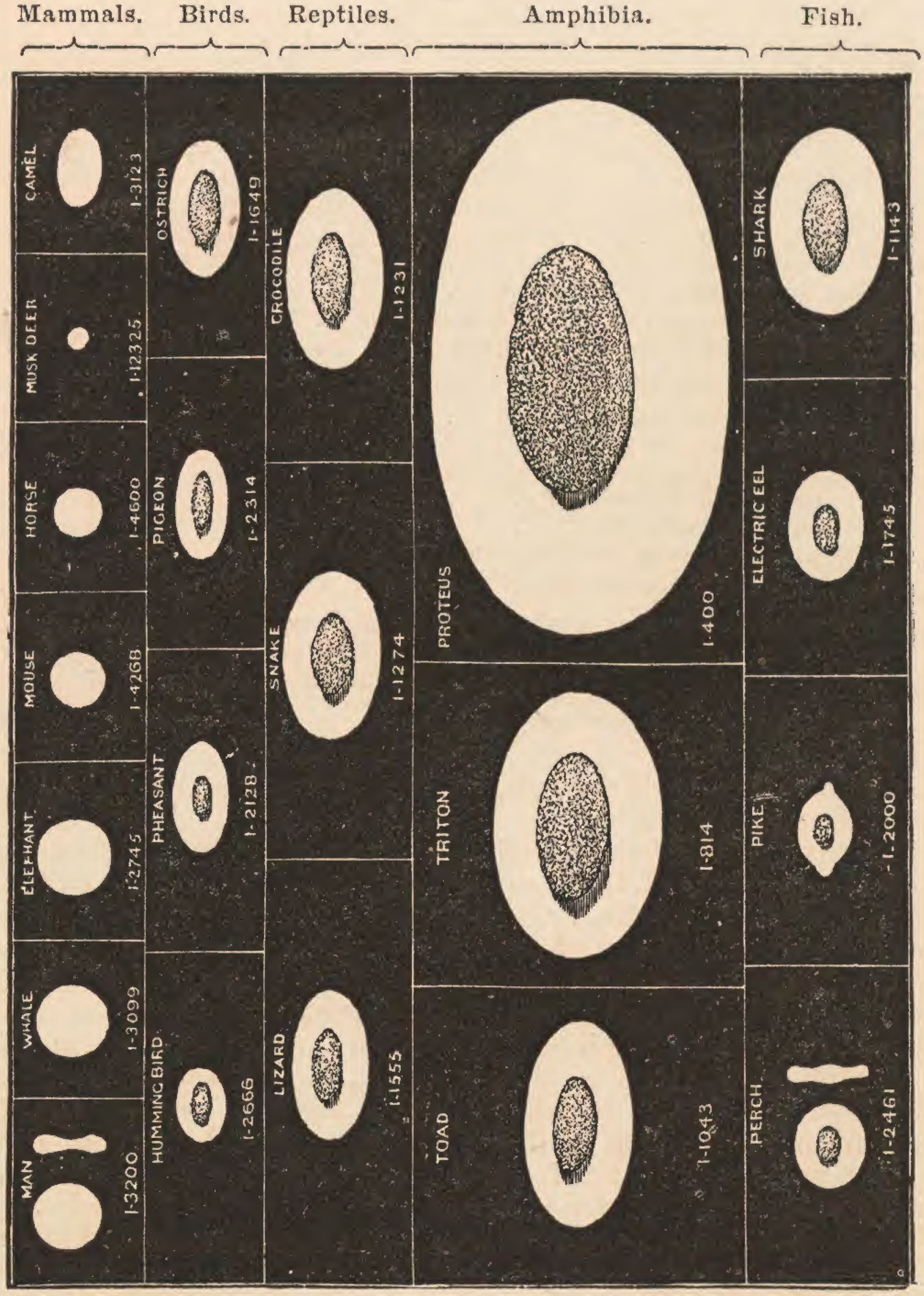
The *development* of the blood is an obscure subject. There appear to be two sets of blood-corpuscles ; the first peculiar to fœtal life, originating as primary cells in the *vascular layer* of the embryo ; the others afterwards, in modes not demonstrated. Probably they, as well as the *plasma* or liquor sanguinis, are formed of materials furnished, and vital influence supplied, by the mesenteric glands to the chyle which passes through them. Chyle corpuscles and lymph corpuscles are, in appearance, identical with the colorless corpuscles of the blood. Whether the red blood-corpuscles result from modification of these, or are generated independently, has not yet been rendered certain. Many physiologists believe the *nuclei* of the leucocytes to be developed into red corpuscles.

The *uses* of the blood are, to give nourishment and vital stimulation to all parts of the body ; nutrition by the material which transudes from its plasma through the walls of the capillaries, and stimulation also by the oxygen it conveys. It is likely that the red corpuscles are the principal oxygen carriers, and that the carbonic acid is mainly absorbed by the liquid part (whose salts facilitate its absorption), but partly by the corpuscles. The constant movement of properly aërated blood is essential to life ; and its momentary failure is made known by the cessation of functional activity in the great organs. Thus it is in *syncope*, or fainting ; when the heart ceases to send fresh blood to the brain, unconsciousness results.

Fig. 131.



Typical Characters of the Red Blood-cells in the Main Divisions of the Vertebrata.—The fractions are those of an inch, and represent the average diameter. In the case of the oval cells, only the long diameter is here given.

Chyle.

This is the fluid taken up by the *lacteals* or absorbent vessels of the small intestine. After digestion of food it is milky in character, from the amount of oily matter it contains (lacteals, from *lac*, milk). Passing through the mesenteric glands, the amount of fibrin and of colorless corpuscles and molecules increases. All

Spectrum of arterial blood,
(Stokes, Sorby, Hoppe Seyler, valentin, Bert &c)
two dark bands in yellow and green, & almost entire extinction of the rays from blue & violet. That of venous blood differs, the two dark bands being fused into one — & the shading over the blue rays being withdrawn towards the violet. CO_2 or CO alters the arterial spectrum by pushing the two bands to the right. — Old blood-stains yield the characteristic spectral appearance.
(Transfusion)

(Onimus exper. with "clear serum from a blister placed in a bag of goldbeaters skin, & put below the skin of a rabbit so as to be exposed to warmth & endosmotic currents." Even in filtered serum, "leucocytes" formed.)

Hæmoglobin, Hæmatosin, Cruorin,
Coloring matter of red corpuscles of blood.
Hæmatin, Hæmin, Hæmatoidin, Hæmatocrystallin
derivatives or educts from it.

× Are the red blood-corpuscles cells
that is, have they a wall?

Probably not. My own observation.

Dr. J. G. Richardson affirms it.

Most authorities deny it. Küss
admits it.

Same controversy about the
White corpuscles. These have a remarkable amœboid movement, in water.

As to origin, Rindfleisch charact. spleen as grave
of red, & womb of white c.; latter from former;
& Preyer asserts this last to be
the real succession. ~~grave~~ of former

Many physiologists believe
the nuclei of the white corpuscles to become
developed into the red. Some assert liver
forms r. c. Gray, spleen forms the red corp.
when deficient, destroys when excessive. See next blank page

Neumann, bone-marrow source
of red corpuscles! Bizozzero, Ponfick etc.
accept this.

Pepper, in
Am. Journ. Med. Sci.
Oct. 75: anæmatosis; "aglobulia" Küss.

Do the bl. corp. die? ⊕ Almost certainly.

Malassez blood ... [illegible]

Leukaemia & pseudoleukaemia

bryo; the others afterwards, in modes not demonstrated. Probably they, as well as the *plasma* or liquor sanguinis, are formed of materials furnished, and vital influence supplied by the mesenteric glands, to the chyle which passes through them. Chyle corpuscles and lymph corpuscles are, in appearance, identical with the colorless corpuscles of the blood. Whether the red blood corpuscles result from modification of these, or are generated independently, has not yet been rendered certain.

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Chyle.

This is the fluid taken up by the *lacteals* or absorbent vessels of the small intestine. After digestion of food it is milky in character, from the amount of oily matter it contains (lacteals, from *lac*, milk). Passing through the mesenteric glands, the amount of fibrin and of colorless corpuscles and molecules increases. All the lacteals empty into the thoracic duct; and this terminates at the junction of the left subclavian and internal jugular vein, in the upper part of the left side of the thorax or chest. The obvious purpose of the chyle is to replenish the blood with nutritious, especially fatty, material.

Lymph.

The *lymphatics*, or common absorbents, take up this, as the effused or transuded plasma of the blood, in different parts of the body, not all consumed. Almost all organs of the body have lymphatic vessels permeating their substance. These vessels all pass through lymphatic *glands*, whose precise action is not understood. *Assimilation* is probably their function; that is, preparing their contained fluid for use in nutrition, by rendering it more like the tissues. This function is believed to be shared by the liver, spleen, and, in very early life, the thymus and thyroid glands.

absorption a primary common function

Elementary Solid Forms.

These are molecules *cells*, *nuclei*, *fibres*, *membranes*, and *tubes*. All of them are rounded; none angular. This is an important difference

between *organic* and *inorganic* forms; the latter being very often angular. A crystal is a typical example of the inorganic; a cell of organic form.

Fig. 98.

NUCLEATED CELLS.—*a*. Blood corpuscles. *b*. Nerve cells. *c*. Cartilage cells. *d*. Connective tissue cells. *e*. Elastic fibre cells. *f*. Pigment cells. *g*. Muscular fibres. *h*. Capillary vessels.

The importance of the cell in morphology (science of forms), vegetable and animal, is very great. Prominent in physiology and pathology, from Schleiden and Schwann (the first cell-discoverers 1836–38) to Virchow, has been the cell-theory; according to which *all* activity, for development and functional performance, belongs to cells only. *Omnis cellula e cellulâ* is Virchow's maxim, in his *Cellular Pathology*.

All physiologists, however, do not admit the *exclusive* activity of cells. Dr. Beale asserts two states of organic matter, in the tissues and organs of the living body; *germinal* matter (mostly, but not universally or necessarily, contained in cells), and *formed* material, which has changed from the active to the passive state, from which it becomes effete and excrementitious. The latter is usually farthest from the central and more vital portions of cells or other forms.

Dr. J. H. Bennett advocates *molecular* physiology; believing that activity for development and function resides in the *molecules* or particles, within or without organic cells and other formative elements. Probably there is some truth in all these views; while each is too exclusive. Life is probably the endowment of the whole germ from which the organism is evolved; and pervades all parts, though not with equal intensity or degree, according to their uses and functions.

Organic Cells.

Cells are, when first originated, nearly globular (spheroid) in shape. Mutual compression often makes them polygonal (many-

Leucocytes — since their "migrations" have been shown (by Recklinghausen & Cohnheim) have been guessed by some to be the origins & agents, if not materials, in all constructive nutrition. (Billroth, e.g., holds that the connective tissue corpuscle is merely a "formed" leucocyte.) I regard this supposition as (whether to be proved hereafter or not) at present altogether unfounded, and, in view of all the facts of nutrition, very improbable.

~~Protoplasm~~ ~~Bioplasm~~ &

the "Cell Theory".

1. Glimpses in anticipation, {Aristotle & Galen.

2. Invention of Comp. microscope, end of 16th cent.

3. Observa. of blood-corp. after middle of 17th century {Swammerdam, Leeuwenhoek, Malpighi.

4. Ultimate "fibre" theory of Haller about 1750

5. Wolff, also middle of 18th century — } units,

Theory of cells, formed by organizing power inherent in the living mass.

6. Nucleus, Robert Brown, 1833.

7. Reproduction of cells from cells, Raspail, 1837.

8. Schleiden (plants) "free cell formation" origin of all organic forms from cells.
1838
& Schwann (animals also) (Robin & Onimus yet)

9. Henle – 3 modes of multipl. of cells; 1841 –
a. – budding – b. – endogenous, – c. – segmentation
~~Remak also~~

10. Martin Barry, & Goodsir –
division of nucleus for multipl. of cells.

11. Huxley – expanded Wolff's theory;
"vital forces are molecular forces."

12. J. Hughes Bennett –
Molecular physiology

13. Virchow – Cellular Pathology.

14. Beale, germinal & formed matter, – Bioplasm.

Also Todd & Bowman, (Paget), Robin, Carpenter, & Bennett, –

Gerhardt & Niemeyer & Neuro-pathology,

Protoplasm (Remak, Von Mohl, Max Schultze)

&

Sarcode of animals (Dujardin), = the semi-fluid content of animal & vegetable cells; containing granules, — & often at least in constant regular movement. Huxley describes it as seen in hair or sting of nettle. I have watched it in elongated cells of leaf of Chara, an aquatic plant. A beautiful sight, under a power magnifying 1200 diameters.

Protoplasm similar in plants & animals not identical in any two types. (white of egg. Leucocytes &c?)

Identity an assumption: Dr. Williams, — & a hypothetical idea, only. Stirling, here, versus Huxley.

What makes protoplasm? (Bioplasm of Beale) —

I answer, — life-force, conveyed from a previous living form. — Irritation — molecular "life-movement" —

15. Leydig & Schultze (1856 & 1861) a cell, "protoplasm surrounding a nucleus!" (no wall).

Toads!

16. Brücke, Schultze, Haeckel & Stricker (1861 &) showed that a cell may exist without a nucleus. In cryptogams, — an amœba — a protozoan, & monads. Does not this throw us back (with Huxley) upon Wolff. The life is the endowment of the germ, — from it of the organism, — as a whole.

Persistence of form, mutation of material. Fountain.

3

P

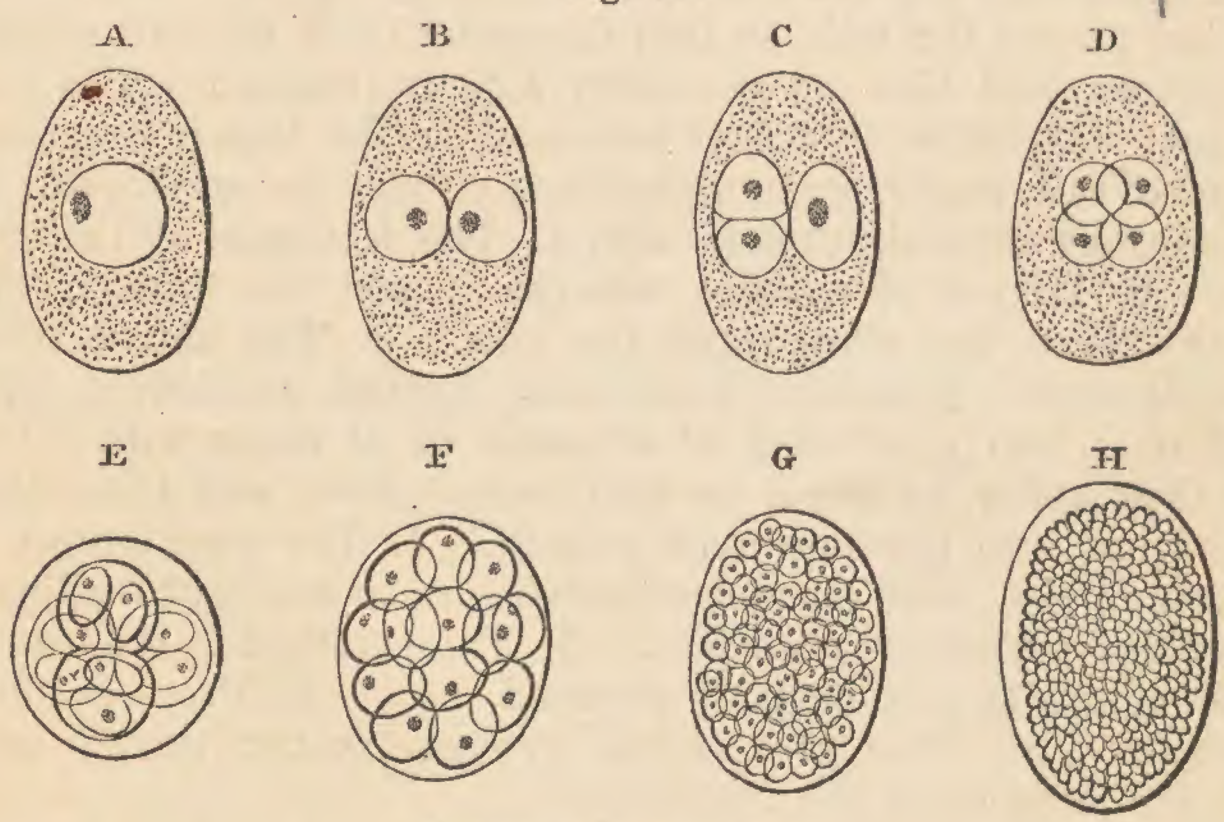
Cells, concluded –

sided), and especially hexagonal (six-sided). By development and transmutation, some cells are converted into fibres, and others into tubes. Some remain as cells until disintegrated and destroyed. Some, as blood cells, chyle and lymph corpuscles, and spermatozoa, float or move in liquids. Others become fixed as parts of firm tissues; as, for example, those of which the prismatic columns of tooth-enamel are constructed. p. 225

Powers ascribed to organic cells, under different circumstances, are various. 1. *Selection.*—Each cell has capacity to select and absorb from the common reservoir, the blood, just such materials as are appropriate to its place and action; fat in the adipose tissue, neurin in the ganglia, urea in the kidney, &c. 2. *Elaboration.*—Some cells only possess this power, to modify or elaborate material selected. Thus, in the liver, bile is partly a product of such an action in the cells of the organ; and so is milk in those of the mammary gland. 3. *Simple absorption* is effected by some cells, as those which cover the *villi* or minute projecting tufts of the lacteals, through which chyle is taken up from the small intestine. 4. *Elimination,* or secretion and excretion, is performed by others, as those of the kidney, sweat-glands, &c. 5. *Aeration* of the blood is accomplished by the vesicles of the lungs, which, however, are larger than ordinary cells, so called. 6. *Conveyance of oxygen* is attributed to the red cells or corpuscles of the blood. ~~Some~~ Most micrologists now deny the ~~character~~ presence of

glands of large intestine

Fig. 99.



Multiplication of Cells.

~~true cells, with~~ a cell wall, to these corpuscles. 7. *Change of form,* producing linear *contraction,* belongs exclusively as a function

The nucleus grows darker & more distinct under acetic acid; and is, more readily than the cell-wall, stained with ammoniacal Solu. of carmine.

to muscle cells. 8. *Sensation*, *thought*, and *emotion*, so far as they are physiologically related, have for their instruments gray nerve-cells in the brain. 9. Lastly, cells may *reproduce* other cells—by subdivision or proliferation, *i. e.*, new cells being formed from them.

Most cells are *nucleated;* that is, have within the cell wall a more minute body, often itself cellular. The action of chemical substances, as acetic acid, is not the same upon the cell-wall and the nucleus. Cells may contain several nuclei. Sometimes nuclei become separately developed. The *contents* of different cells vary much more than their walls; but the *causes* of their selective and other peculiar powers are beyond special explanation. A plausible supposition as to the origination of some cells has been founded upon an experiment of Ascherson; viz., on dropping very small drops of oil into a solution of albumen, each droplet surrounds itself with an albuminous pellicle or covering, resembling closely an organic cell. A → Capillarity ←

Partial explanation, only, of the transmission of fluids through cells and other elements of tissue, is found in *osmosis*, or endosmosis and exosmosis. These terms are applied to the transition of fluids through animal membranes; so that, two different fluids being on opposite sides of a membrane, an exchange takes place between the two. For example, if a fresh piece of membrane be stretched between a solution of salt and a quantity of pure water, after a while the solution will become more dilute, and the water on the other side will taste of salt. *More* of the pure water, however, has passed through, so that the quantity of the salt solution is increased, and that on the other side is lessened. The more abundant imbibition is called *endosmosis;* the lesser, *exosmosis*. Instead of salt, sugar, gum, albumen, &c., may be employed.

Conditions affecting osmosis are, 1. The freshness of the membrane. 2. Extent of contact between it and the liquids. The greater this is, the more rapid the flow. 3. The nature of the materials used. Dutrochet found that, through ox-bladder, water would pass into a solution of albumen or of sugar with a force more than twice as great as into one of gum, and three times as great as into a solution of gelatin. 4. The position of the membrane; *e. g.*, with mucous membrane, as to which of the liquids the mucous surface is presented. 5. Temperature. Endosmosis is most active at a moderately elevated heat. 6. Pressure affects it considerably. The greater the pressure, other things being equal, the more rapid the imbibition.

Sometimes, as when water and albumen are used, endosmosis occurs without any returning exosmosis. Generally, the stronger current is from the less dense to the more dense liquid. In the case of alcohol and water, it is, as an exception, the reverse. It appears that the force of osmosis does not depend upon the degree

natural & fats,
oils, as ~~butter, as well as cream~~,
an albuminous pellicle encloses each
oil-drop. This fact has been recently
found available in modifying the process
of ~~making soap~~ separating the fatty
acids (stearic, &c), as for candles.

Fibre-cells. Some late histologists
assert ~~red~~ muscle-fibres to be developed
~~through the~~ form of elongated fibre-cells.

Osmose very important in
physiol. transudations —
e.g. nutrition (not it alone), absorp-
-tion of lymph & chyle — [Contrast villi & bladder]
& pathol. — as Dropsy —
diarrhœa in Cholera?. action of purgatives —

(4)

P.

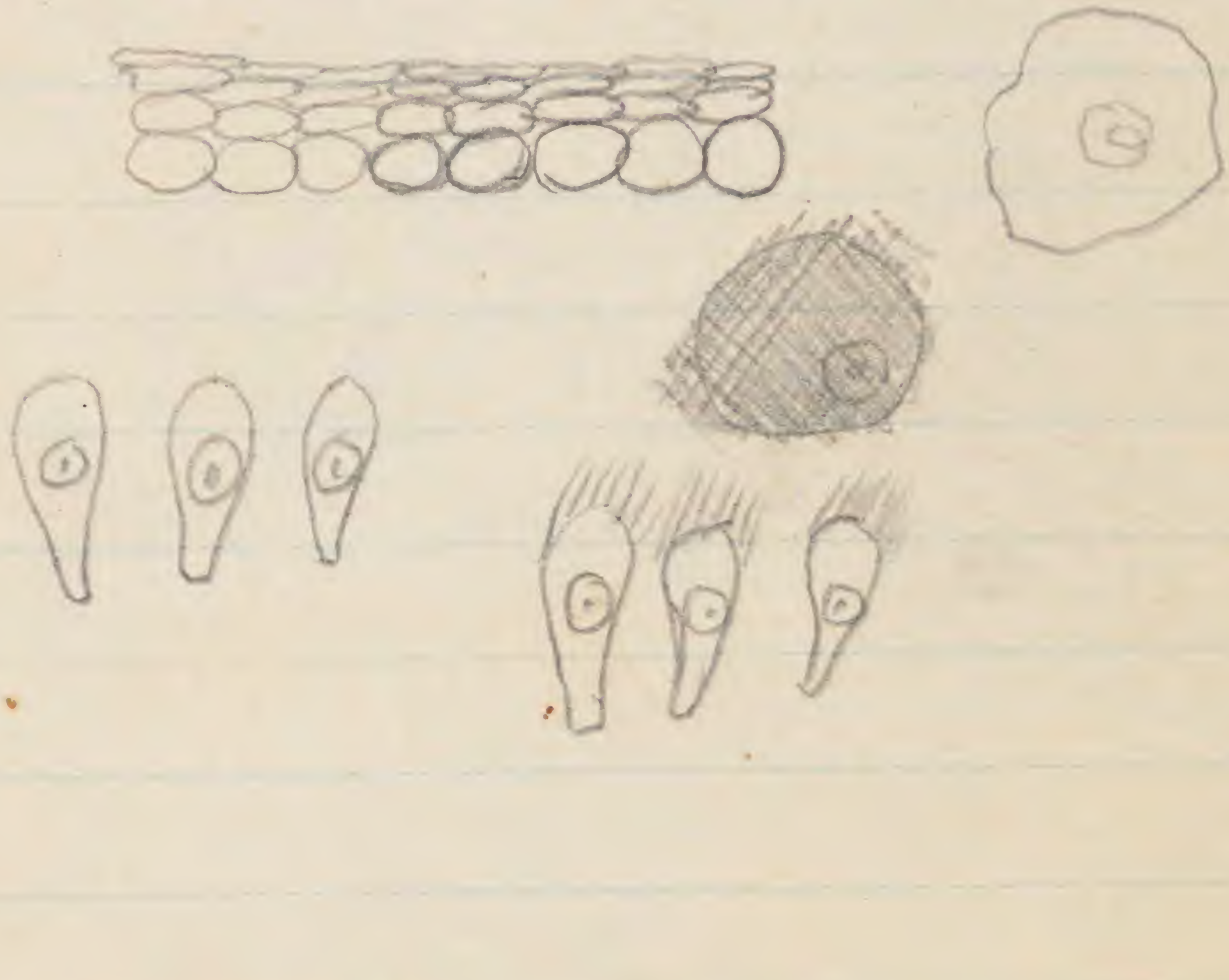
Dialysis; ——

&

Tissues –

Salts, and sugar are crystalloids; albumen, gelatin, starch, hydrate of aluminium, and hydrated silicic acid, colloids,

Diffusion the essential part of the process; e.g., a grain of salt in a hogshead of water — compared with a drop of white of egg in the same.



of attraction of the liquids for each other, but upon the attraction of the membrane for the liquids, by which it takes them into, and passes them through its substance. The movement of a fluid in a continuous current, as it occurs constantly during life, always favors endosmosis. So does the extent of contact produced by the minute ramification of the capillaries. *Albumen*, under ordinary circumstances, as already stated or implied, is not capable of endosmosis or exosmosis itself, though water will endosmose into it.

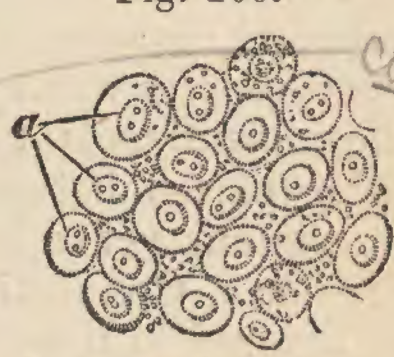
Dialysis is a name given by Graham to a process of transition of materials in solution through a permeable septum, by which substances mixed together may become separated from each other. He distinguishes bodies into *colloids* and *crystalloids;* the former, comprising organic matters and a few inorganic ones, not passing through animal membrane used as a *dialyser*, while crystalloids do, freely. This property or process no doubt has its influence in the living body, although its bearings are not yet fully discerned.

Fibres and Membranes.

It is almost certain that *fibres* are *directly* organized from plasma, in the white fibrous and yellow elastic tissues. Of simple *membranes* so formed, probably the only examples are, the capsule of the lens of the eye, the layer at the back of the cornea, and the "basement membranes" of mucous tissue, upon which cell-layers are formed. Over to p. 226.

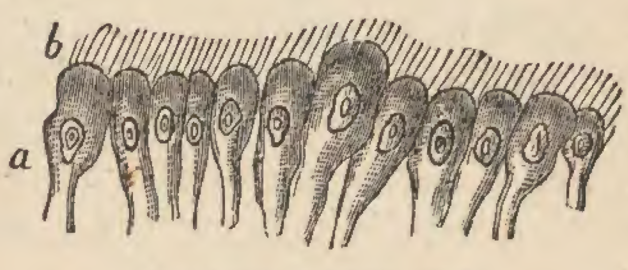
In connection with the latter, allusion may be made to the variety of forms of such cells as compose these layers. Three kinds of epithelial or pavement-cells are found: *tessellated*, *cylindrical*, and *ciliated* epithelium. The first are rounded at first but become flattened and polygonal. They exist in the cuticle or scarf-skin, conjunctiva of the eye, the mouth, pharynx, œsophagus, vagina, serous and synovial membranes, many gland-ducts, and bloodvessels and lymphatics. *Cylindrical* or *conical* epithelial cells are found from the cardiac orifice of the stomach along the alimentary canal to the anus, and lining the gland-ducts communicating with the stomach and intestines; also, in the greater portion of the male urino-genital apparatus, and in the female urinary passages. *Ciliated* cells are so called from the presence on their summits of extremely minute *cilia*, or lash-like processes; which, during life and

Fig. 100.



PAVEMENT EPITHELIUM.

Fig. 101.



CILIATED EPITHELIUM.

for a time after death, are incessantly in waving motion; compared, when viewed under a microscope, to the undulations in the wind of a field of grain. The result of their movement is usually to produce a current (in a tube, for example) in one direction. Such cells are found, in the human body, lining the nasal cavity, except the strictly olfactory portion; in the frontal sinuses, lachrymal canal, and mucous surface of the lids of the eye; the upper part of the pharynx, soft palate, Eustachian tube, and middle ear or tympanum; all the respiratory tract from the glottis to the terminating ramules of the bronchial tubes; in the epididymis of the testicle; and in the female generative organs from the neck of the uterus to the fimbriated extremities of the Fallopian tubes.

Next p. 223—

Tissues.

As all the tissues are compounded of the few elementary forms already mentioned, with more or less modification of the contents of cells and tubes, and of structureless intervening substance, their classification must be somewhat arbitrary. The clearest and most convenient arrangement of them is the following:—

all called by some Connective tissues

Connective,	Fatty,
Fibrous,	Mucous,
Elastic,	Serous,
Cartilaginous,	Glandular,
Osseous,	~~Parenchymatous,~~
Dermoid,	Muscular,
Corneous,	Nervous.
(Tubular)	

~~To these might be added, perhaps,~~ *tubular* tissue is that of the capillary bloodvessels, lacteals, and lymphatics.

Connective tissue is also called areolar or cellular tissue. It is the most abundant of all, and is the *packing* tissue of the body; being placed between muscular fibres and nearly all other closely contiguous yet separable parts. Its structure is essentially fibro-cellular. Connective-tissue *corpuscles* (irregularly stellated) are recognized in it by Virchow & others. +

Fibrous tissue is white, tough and flexible. It exists in ligaments, tendons, periosteum, and certain membranes, as the dura mater of the brain, and the outer layer of the pericardium; and in the outer coat of the arteries.

Elastic tissue is yellowish in color, and microscopically more *tangled* in structure than the white fibrous tissue. Some of the ligaments of the spinal column possess it, and it is united with muscular tissue in the middle coat of arteries. It contains *elastin*, which differs somewhat from gelatin.

Cartilage is met with in many places in the body; between the vertebræ of the spine, between the ends of bones, at the joints con-

× Is it the originator of other tissues?

Not improbably of some — especially skin, ligaments — cartilages — ~~perhaps~~ possibly muscle; hardly — nervous tissue, Lowest in organisms, except fat & bone,

Migratory leucocytes of Recklinghausen;

Degeneration of skin (after burns, e.g.) or rather insuff. repair — & of ligaments — & muscles, leaves connective tissue; so also in glands — & in uterus — Chondroid degeneration?

"Areolar Hyperplasia" of Thomas;

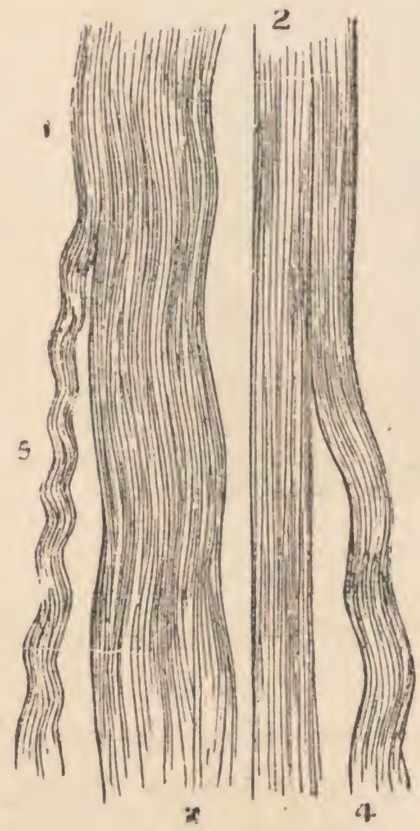
= "Irritable Uterus" of uterus — of Hodge & others.

Cartilages may therefore be classified as temporary and permanent (the latter are, sometimes, subdivided as cellular, hyaline and fibrous).

necting the ribs with the sternum, making the flexible portions of the nose and ears, and the edges of the eyelids. It is also the basis of formation of the bones.

Osseous or bony tissue is compounded of ostein or bone-cartilage and mineral matter, chiefly phosphate of ~~lime~~ calcium (see *Anatomy*). A

Fig. 102.



WHITE FIBROUS TISSUE.

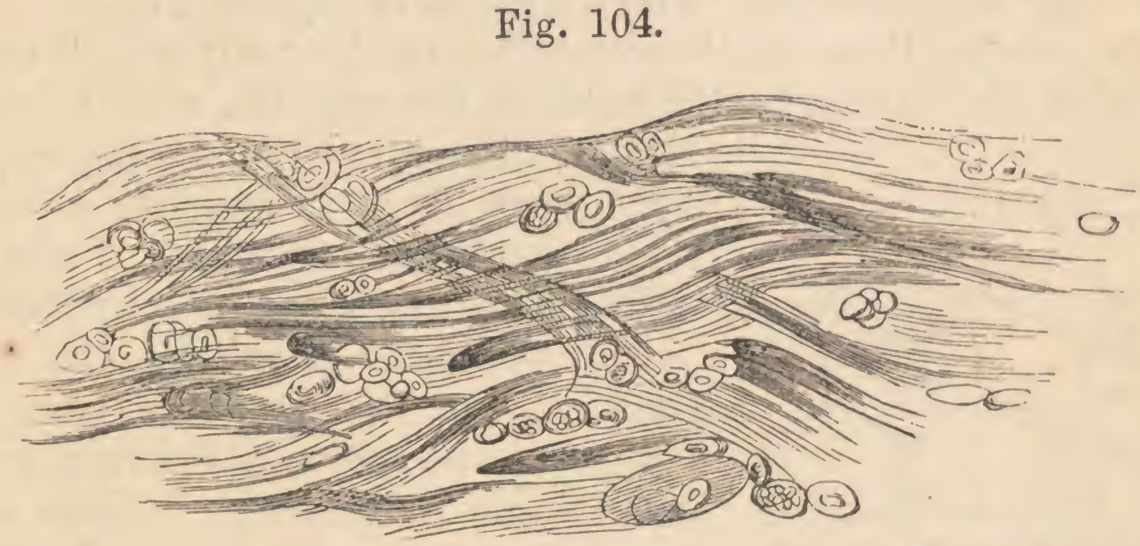
Fig. 103.

YELLOW FIBROUS TISSUE.

In sputa of phthisis

modification of it is seen in the *dentine* of the teeth; which also present two other peculiar substances, the *cementum* which covers the fangs, and *enamel*, the covering of the crowns of the teeth.

Fig. 104.

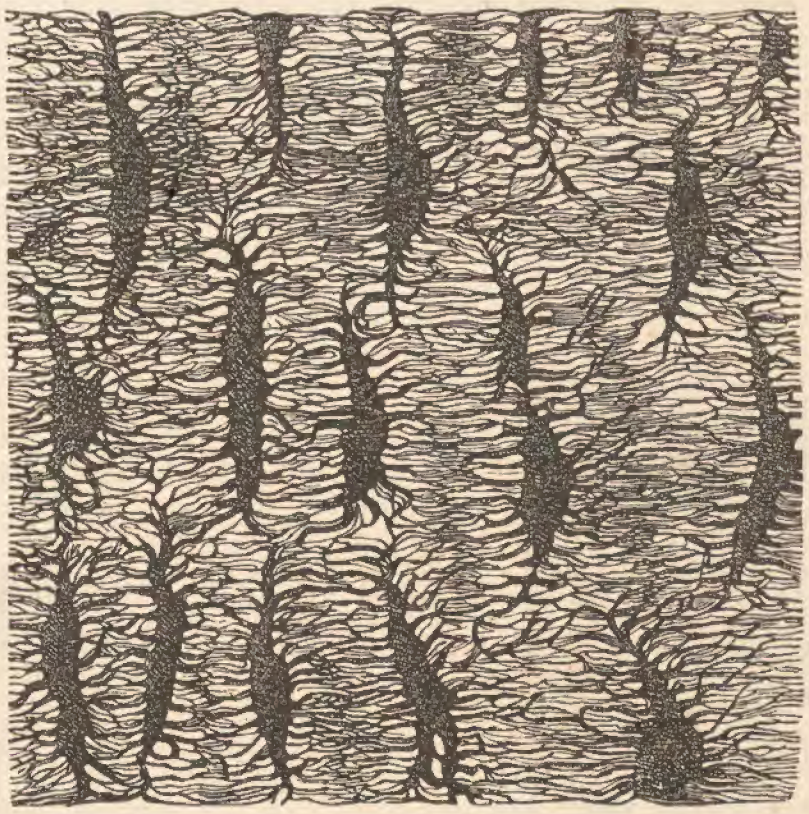


FIBROUS CARTILAGE. FROM THE SYMPHYSIS PUBIS. MAGNIFIED.

Dermoid tissue, or skin, is ~~intermediate between, or~~ composed of fibrous and areolar or connective tissue (see Anatomy).

Corneous or horny tissue is represented in man by the nails; the

Fig. 105.



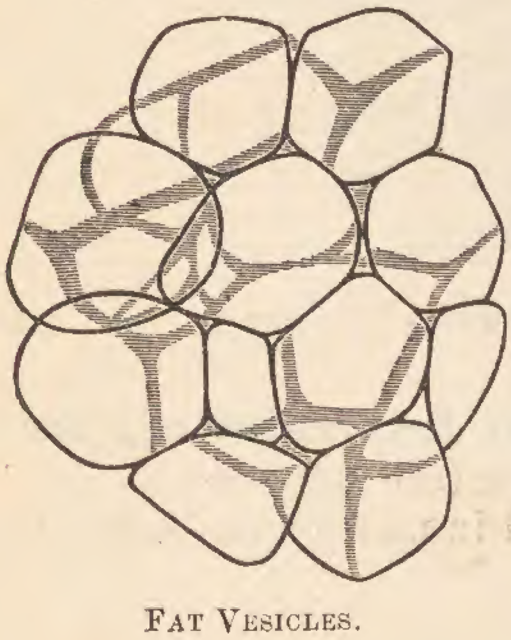
OSSEOUS TISSUE.

hairs are not far removed from it, although of a somewhat special tubular structure.

Fatty tissue is formed by the distribution of drops of semi-fluid oleaginous matter in cellular spaces of connective tissue. Fat lies under the skin, and gives roundness to the face, trunk, and limbs; besides furnishing cushions to prevent pressure on other parts, and, by its non-conducting power, to protect the body from undue loss of heat. Cushions of fatty deposit are also found behind the eyeball, around the heart, kidneys, and other parts. Fat is absorbed when waste of the body exceeds the supply of food; seeming to afford fuel for the "combustion" which generates animal heat.

Mucous tissue lines all those cavities of the body which communicate with the exterior; the orbit of the eye, the mouth, nostrils, throat, alimentary canal, bladder, vagina, uterus, &c. It consists of a basement membrane, on which is a layer of epithelial cells, already described.

Fig. 106.



FAT VESICLES.

Serous tissue *envelopes* the organs contained in the great cavities of the body; as the lungs, abdominal organs, &c. It is in those situations always *double*, to lessen friction. It is thin, and very smooth, covered with epithelium, and moistened with serum or serosity.

Glandular structure is not identical in all the glands; but in each consists of *cells*, clustered or conglomerated

Squamous or tesselated

Beauty is much aided by due proportion of fatty tissue,

Allied to Skin —

Extraordinary is the change of length in the slender ~~tentacles~~ of the hydra; 100 times as long at one time as another; which is there action; shortening or elongation? Or both? Not determined yet.

Contractile filaments of dionaea &c.

together variously. The differences belong to descriptive anatomy.

Inter-cel-lular *Parenchymatous* tissue is spoken of as existing in the liver, kidneys, lungs, and other large organs. The analogy between the lungs and secreting glands is close; but the air vesicles are larger, and open freely into the bronchial ramifications. ?

Muscular tissue is of two kinds. That of the voluntary muscles (of locomotion, &c.) is red, and composed of *fibres;* each fibre of *fibrils*, and, as shown by the microscope, each of these of *cells*, (sarcous elements) end to end.[1] *Striæ* or circular marks indicate the line of separation between the cells? of the fibrillæ of a fibre, bound in its sheath or *sarcolemma*. The contraction of this red, striated or striped muscular tissue, occurring by the widening and shortening of the fibrillary cells, is quick, limited, and short in duration. In the heart only is this striped tissue altogether beyond the influence of the will; although it is almost entirely involuntary in the pharynx except at its upper part, and is rather controlled by emotion than by will in the muscles of expression in the face. Both also — always Alter-nating action; Marey.

Fig. 107.

STRIPED MUSCLE.—1. Longitudinal cleavage. 2, 3, 4. Transverse cleavage. 5. A detached disk. 7, 8. Separate fibrillæ.

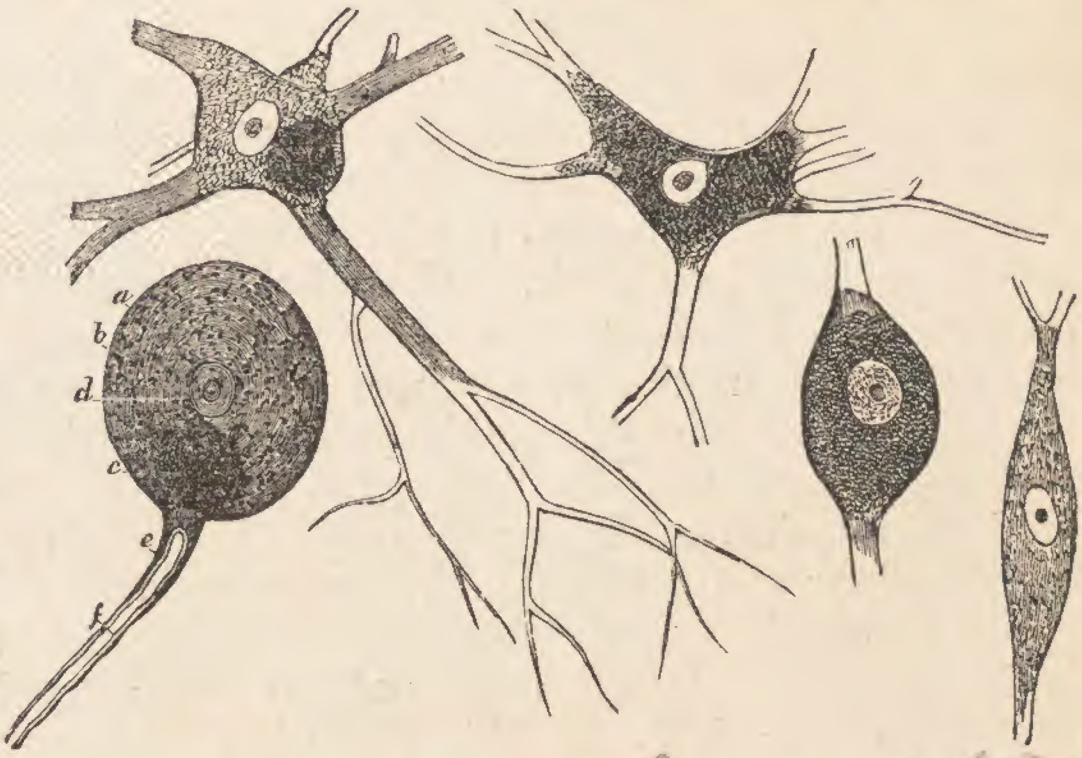
Fig. 108.

SMOOTH MUSCLE

The other muscular tissue is pale or white, and non-striated; it is formed of spindle-shaped fibre-cells, overlapping each other; very often in bands rather than in bundles. It is always involuntary. Examples of it are in the muscular coat of the stomach and intestines,

[1] The truly cellular nature of these minute muscular elements is now denied by several physiologists.

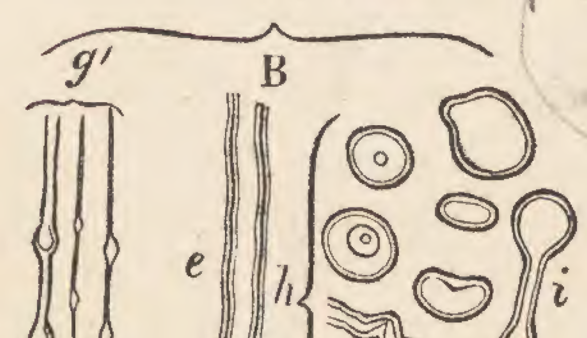
Fig. 109.



NERVE CELLS.

principal the vis;

Fig. 110.



and in that of the bladder; the uterus, especially during pregnancy; in gland ducts, and the middle coat of arteries.

Nervous tissue is also of two kinds; the *gray vesicular* and the *white tubular;* the first in the ganglia, spinal marrow, and brain, though not constituting the whole of these. The first, formed of nucleated nerve-cells, many of them with processes (bipolar, multi-polar), is active, cumulative or reflective in function; the other, white tubular matter of the nerves and commissures, is simply capable of transmission and communication. Some of the nerves, especially of the "sympathetic" or ganglionic system, are gray and gelatinous; but still unlike the gray or cineritious nerve-tissue of the ganglionic centres.

NERVE FILAMENTS.—A. Diagram of nerve-tubule. *a.* Axis cylinder. *b.* Inner border of white substance. *c, c.* Outer border of same. *d, d.* Tubular membrane. B. Tubular fibres. *e.* In natural state. *f.* Under pressure. *g, g'.* Varicose fibres.

Stud, on Organ Morphology

Nerves all soft soon after death. Central axis-cylinder & medullary sheath of white substance of Schwann. This last wanting in sympathetic nerve trunks & branches, and in branches of olfactory nerve. Neuroglia is the delicate sheathing material of nerves –

Functions, next –

Veg. & Anim.

Org. Nutr. — of rela. — musc. & nervous.

Diff. bet. pl. & animals —

compos. — food — aera. — complex org.

Sensa. — & locomo. —

Sens. pl. — Drosera — Ven. Flytr. Dionæa manipulus

Compass plant —

choice – ~~structure~~ electr. currents —

Place of Man —

Peculi. of Man in (comment).